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CIP in 1996

The International Potato Center Annual Report

G. CHANG

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A Year to Remember

The events of 1996 will likely be remembered at CIP for many years to come For the Zandstra and Fajardo-Christen families, the final days of the year will always remind us of the terrible incident that took place at the Japanese ambassador's residence in Lima, the joy of liberation, the sadness and concern for those forced to stay behind, and, four long months later, their ultimate release

As this report is being written, the events that began to unfold on December 17 have thankfully been resolved. While the incident itself is an isolated case, and has had only a minor impact on CIP day-to-day operations, it is difficult to ignore its effect on the lives of so many loyal friends and colleagues. For that reason we dedicate this report to Ambassador Morihisa Aoki, Foreign Minister Francisco Tudela, and Agriculture Minister Rodolfo Muñante, and to their families who bravely endured so many months of captivity

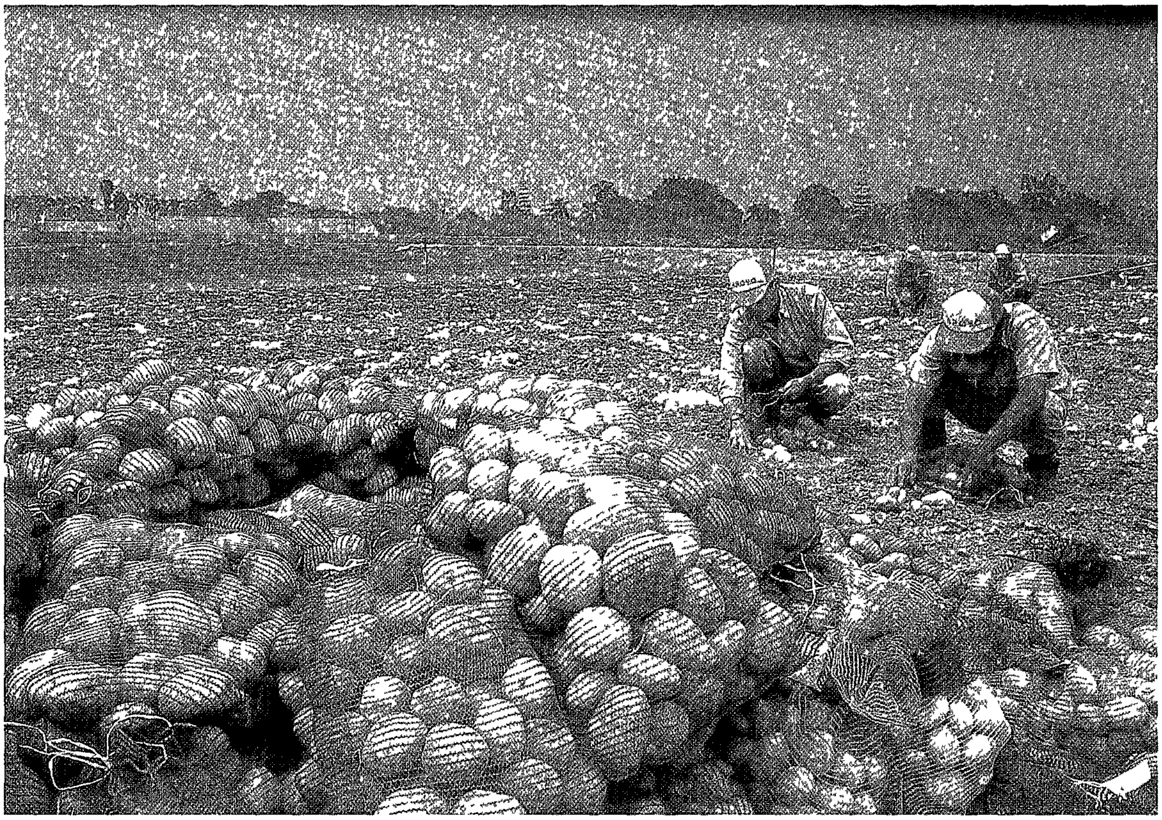
Were it not for the events of December, I undoubtedly would have begun this report with a word of thanks to our donors In these difficult financial times, it is gratifying to report that the donor community saw fit to recognize the Center by providing a record US$26.3 million in 1996. Their commitment is an indication that they continue to recognize the vital role of research in solving the fundamental problems of hunger, environment, and poverty

At one time, international agricultural research centers such as CIP were engaged solely in efforts to boost productivity Today, we have come to accept the larger responsibility of making sure that increased agricultural production does not take place at the expense of the environment, or exclude those who are most in need This fundamental principle was evident in several important planning exercises conducted at CIP in 1996. The first was a priority-setting exercise that helped us identify where research is most urgently needed and most likely to produce results. The exercise, the second in recent years, also provided an opportunity to evaluate our programs for their effect on poverty and the sustainability of the natural resource base. The results of the exercise are explained more fully on page 11 in an article titled *Focus on Outputs: Goals for 1998-2000*

As expected, potato late blight disease was ranked as CIP's top priority, not only because of the urgency of the problem and its impact on poverty and the environment but also because of our scientists' belief that rapid progress could be made and that an investment would provide a high rate of return. News about our collaborative late blight program can be found in the article titled *Taming the Late Blight Dragon* on page 18.

Not all the results of the priority-setting exercise were as predictable as late blight, however In a surprising development, a new project designed to increase the productivity of sweetpotato was ranked second highest in our research portfolio The project, designed to increase dry matter yields, addresses problems faced by two distinct farmer groups those who grow the crop for industrial purposes and those for whom sweetpotato represents food security Additional information on our sweetpotato research program can be found starting on page 6.

CIP's late blight and sweetpotato projects are just two of 19 consolidated projects that evolved from the priority-setting exercise and from a project-streamlining initiative carried out

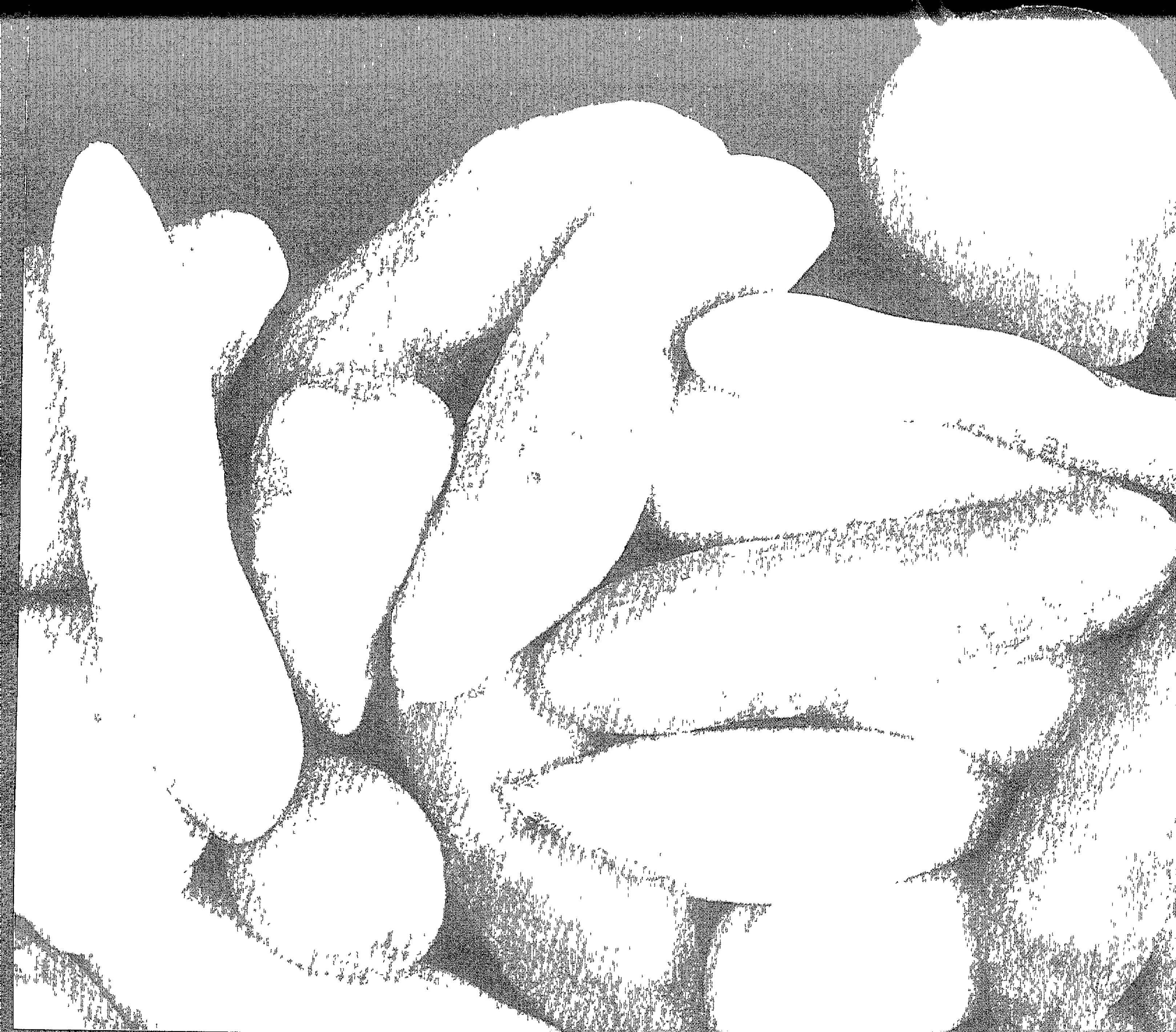


during the year. Together, these efforts have provided much-needed information for the Center's *Medium-Term Plan 1998-2000*. The plan, completed in the last days of 1996, was somewhat delayed by the hostage crisis in Lima I am pleased to report, however, that it was well received by our Board, by the CGIAR Technical Advisory Committee, and by many donors. It provides a clear statement of our research goals and strategy and is available upon request (it can also be accessed through our Web site, http //www cipotato org)

In closing, I want to again express my thanks to all those friends and colleagues who supported the Zandstra and Fajardo-Christen families in their time of need and who continue to support CIP in its program of activities. The events of the year have demonstrated, as perhaps nothing else can, the vital role of community and the importance of commitment to science, development, and human well-being

Hubert Zandstra
Director General

Sweetpotato Research: Evolving Priorities



Sweetpotato is a vital part of the food security equation in some of the world's poorest nations. Starting in 1998, the beginning of CIP's next medium-term plan period, seven of the Center's 19 projects will be devoted to sweetpotato research. The projects address problems ranging from the plant's vulnerability to pests and diseases to the lack of efficient small-scale postharvest processing technologies. Together, they are designed to provide technology that will help farmers forestall disastrous food shortages, particularly in sub-Saharan Africa, and exploit the crop more efficiently for industrial purposes.

Food Security in Uganda: The Sweetpotato Option

In few places are the problems faced by farmers as acute and varied as they are in northeastern Uganda. Begin with a long dry season that makes growing many crops—including sweetpotato—impossible for nearly half the year. Add a poorly developed infrastructure (it is five hours by substandard roads to the main market in Kampala), limited warehouse facilities (driving prices down during harvest times), and a lack of access to credit for small farmers. Finally, consider the long-running civil disturbance (in which draft animals were killed or stolen) and a devastating disease in cassava, the major staple crop. The result is a potentially disastrous food security problem. For many farmers, sweetpotato is an important part of the solution.

"The constraints that farmers face in sweetpotato production are so complicated, a single-technology solution would never work," says Nicole Smit, an integrated pest management specialist based in CIP's liaison office in Uganda "That's why we're putting our energy into ICM (integrated crop management)—a mix of varietal improvement, pest management, market development, and other technologies that correspond to the complexity of life on the ground "

Cassava Wiped Out

In 1996, a pilot project was launched in three villages in the economically depressed Soroti district, where cassava has been virtually wiped out by cassava mosaic virus and sweetpotato has become the main staple and cash crop A CIP sweetpotato team is working closely with local farmers, scientists from the Ugandan national sweetpotato research program, and the district's extension service Links are also maintained with cassava researchers from the National Agricultural Research Organization and the International Institute for Tropical Agriculture in Nigeria

"The problems in northeast Uganda are in many ways typical of those in other parts of the continent," says Peter Ewell, who heads CIP's sub-Saharan Africa regional office in neighboring Kenya "They include the risk of drought, the vulnerability of crops to pests and diseases, inadequate marketing and storage, the limited use of the crop in processed products, and the lack of access to credit for small farmers This project will let us test an integrated problem-solving approach while helping some of the poorest farmers in Africa "

Smit adds that the most important partners are ultimately the farmers "It doesn't matter how good the technology is if no one will use it," she says "With ICM, farmers are involved in every step of the process—from identifying constraints to testing possible solutions and evaluating their impact "

Upgrading Materials: Upgrading the System

Increases in sweetpotato production may prove feasible if scientists can improve the quality of planting materials used by farmers In most developing countries, farmers take vine cuttings from mature plants at harvest time, and use these for propagating the next crop. But mature vine cuttings are less productive, less consistent, and more prone to disease than the sprouts or "slips" that grow on roots and young vine cuttings

"Farmers in industrialized countries have been planting sprouts for years," says Mahesh Upadhya, CIP's program leader for propagation and crop management "Our challenge is to create a viable system for using them under the varied conditions of the developing world " Those conditions include everything from drought and flooding to diseases and poor soils—frequently compounded by shortages of cash with which to purchase costly inputs.

E CAREY

One of CIP's most important roles is to marshal research results from a variety of sources For example, CIP food scientists in Central and East Africa are working to adapt processing methods from other parts of the world to local conditions and tastes They are also helping Ugandan researchers test low-cost techniques for protecting dried sweetpotato chips from storage pests.

Integrated Solutions

Possible solutions involve methods for reducing sweetpotato weevil damage in the field, storing fresh roots, protecting dried sweetpotato products from common storage insects, and developing new uses and markets for both fresh and processed sweetpotatoes

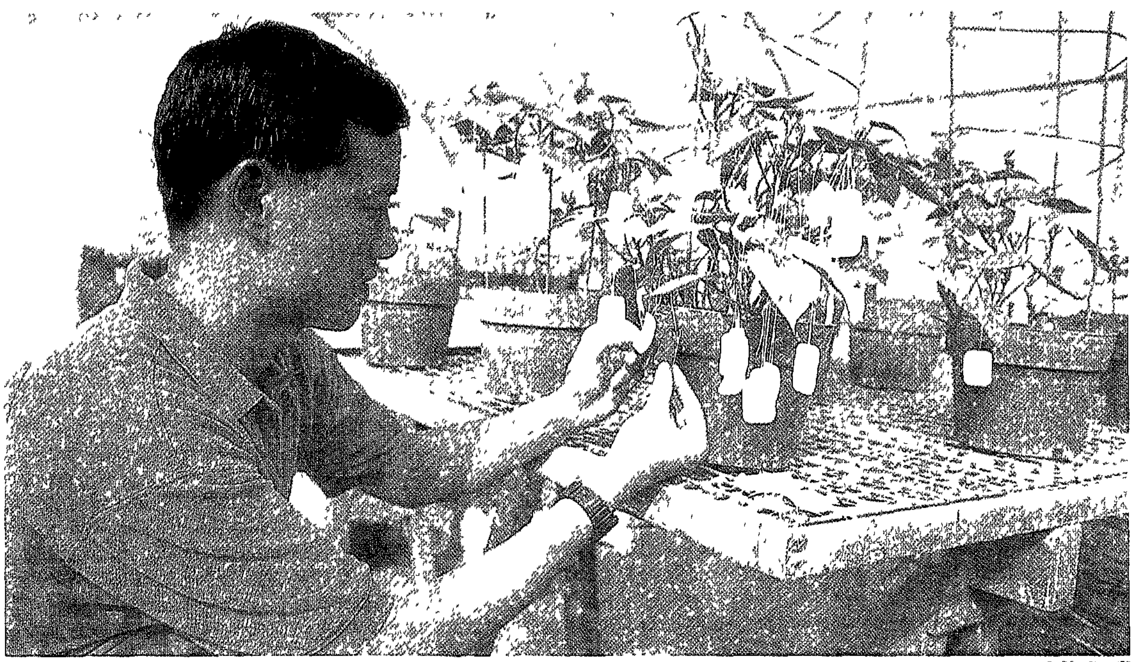
"One of the most clearly defined needs is for marketable, early-maturing high-yielding varieties that are less vulnerable to weevils than those currently being grown," says Ted Carey, CIP's regional sweetpotato breeder Again, farmers' field trials will be an essential part of the breeding and evaluation process Adds Ewell "CIP has access to a wealth of genetic material and international expertise These broaden the choices available to the team, but it's the collaborative work in the field which will make real impact possible "

Building on earlier genetic studies, CIP will launch a project in 1998 to produce and disseminate technologies for improving, using, and maintaining sweetpotato planting materials under farm conditions in South and Southeast Asia, Africa, and the Caribbean. The project budget represents a near-doubling of resources for CIP's sweetpotato seed unit. The goal is to increase sweetpotato production by 20% in target areas, both by boosting yields and reducing losses to biotic and abiotic stresses.

"This is the sort of technology that could have a tremendous impact for farmers in developing countries," says Upadhya. "By improving planting materials, you make the entire system more efficient. And if you are searching for productivity gains, efficiency is often the best place to look."

Dry Matter Counts

"To increase fresh yields you normally have to increase the use of water and fertilizers," says sweetpotato project leader Dapeng Zhang. "But if you can breed new varieties with 5% more dry matter," he says, "it's like increasing the fresh yield 15-20% without using more inputs."



C. ROSSENOUFF

One of the highest scorers in CIP's 1996 priority-setting exercise was a new project—an effort to increase the dry matter yield of sweetpotato. The strong showing was largely due to the project's potential impact in China, where 85% of the world's sweetpotatoes are grown. But the effects should also be felt in Southeast Asia and sub-Saharan Africa, where the crop is often vitally important to the poorest farming families. Overall, average benefits were estimated at $309 per hectare, spread over the largest geographic area of all CIP projects.

"The idea is not to produce more tons of sweetpotatoes per hectare," explains sweetpotato breeder Dapeng Zhang, the project leader. "It's to produce more usable material in every sweetpotato."

Current breeding efforts are aimed mostly at increasing fresh yields and fortifying plants against stresses such as drought, flooding, insects, and diseases. The dry matter project will focus instead on the postharvest characteristics of the roots themselves.

There is plenty of room for improvement. Dry matter content among the 5,000 accessions in the sweetpotato gene bank maintained at CIP can be as high as 45%. But the most commonly cultivated varieties in the project areas range from just 20% to 35%. Moist, orange-fleshed varieties are important in places where sweetpotatoes are an occasional part of a varied diet. But in Africa (where sweetpotato is an important energy source) and Asia (where the crop is used in animal feed, starch production, and industrial processes), dry matter counts.

The key to CIP's contribution is the genetic diversity available in its gene bank. In China, CIP will provide national breeders with new sources of genetic material—and new breeding techniques—to boost productivity and improve quality. In Southeast Asia, CIP will help national program breeders produce fast-maturing (or "early-bulking") pest-resistant varieties adapted to local conditions. In Africa, CIP breeders and their partners will produce hardy modern varieties that are high in energy and essential vitamins.

"To increase fresh yields, you normally have to increase the use of water and fertilizers," says Zhang. "But high dry matter is highly heritable. If you can breed new varieties with 5% more dry matter, it's like increasing the fresh yield by 15-20% without using more inputs."

Focus on Outputs: Goals for 1998–2000

In September 1996, CIP conducted an intensive priority-setting exercise to focus the Center's efforts on the most pressing problems in the potato- and sweetpotato-growing world. The result, to be implemented with the Center's Medium-Term Plan for 1998-2000, should be a clearer sense of direction for CIP scientists.

"The most important change is the emphasis on concrete, measurable outputs," says economist Tom Walker, who organized the exercise "CIP is not a university, where an interesting research project justifies itself Our mandate is to produce results "

Scientists and administrators spent three days discussing the potential impact of 15 research projects Considerations included the probability of scientific success, the geographic coverage of new technologies, anticipated benefit per unit of production (such as dollars saved or gained per hectare), and the expected level of adoption in target and spillover countries The results of those discussions were incorporated into a project appraisal model that measured the economic benefits of the research outputs up to the year 2015

The Poverty Modifier

The rankings were then subjected to "modifiers" based on the priorities of the Consultative Group on International Agricultural Research, CGIAR, the umbrella group of donors that provides funding for CIP and other international centers A premium was added to projects with substantial environmental benefits, and a discount was levied against those whose technologies could be supplied by other institutions in the

CIP and Poverty

Poverty was an important consideration in the September 1996 priority-setting process Not only were ratings weighted for the "leverage" projects bring to the fight against poverty, but the initial identification of projects was made after an analysis of poverty levels in target countries and regions

Although the ranking system is new, it is consistent with CIP's historical bias in favor of low-income farm families in some of the world's poorest places Since its inception, CIP has had proportionally more impact in poorer countries, particularly those with weak national agricultural research systems (NARS) Even in countries with strong NARS, CIP's work has focused on the poorest areas—such as Sichuan province and Inner Mongolia in China, and the northeast of India.

CIP's technology development efforts have also generally favored low-income farmers Rather than design expensive mechanical equipment for use in true potato seed (TPS) production systems, for instance, researchers have emphasized labor-intensive technology, such as manual transplanting and inexpensive seedling tuber management practices. In East Africa, where poor women farmers harvest sweetpotatoes piecemeal throughout the growing season, CIP is developing integrated crop management practices appropriate to local conditions

Technology development at CIP has generally favored low-income farmers For example, TPS production systems *(see page 24)* research has emphasized labor-intensive technology, such as village-level seed production and manual transplanting of seedling tubers

absence of CIP Finally, the ratings were weighted according to the poverty level in the projects' impact areas

"CIP has been through priority-setting exercises before, but this is the first time we've rewarded projects explicitly for their positive impact on poverty and the environment," says Walker "It made the process more complicated, but it also made it more responsive to the Center's mandate"

Late Blight Ranked Number One

Work in potato late blight, with an estimated per-hectare benefit of US$530 and a potential impact area of nearly 3 million hectares in 40 countries, remains the Center's top priority for the planning period A new effort, designed to boost the dry matter yield of sweetpotato, ranked second, whereas controlling potato viruses ranked third One project whose rating jumped when weighted for its potential anti-poverty effect was integrated crop management of sweetpotato

Some projects that scored well in previous priority-setting exercises received significantly lower rankings this time around For example, potato seed systems fell dramatically—a reflection of the relatively small geographic area of impact and concerns about the likelihood of research success Other areas of work, such as integrated pest management, virus research, and sweetpotato product development, maintained their former priority rankings

With changes in priorities come changes in budgets The balance between investments in potato and sweetpotato research will shift during the Medium-Term Plan period from a 60 40 ratio to a ratio of 75 25 Investments in late blight research will increase from about $3 million a year for 1995-1997 to nearly $5 million for 1998-2000, the increased spending is justified by economic returns estimated at more than $250 million between 1998 and 2015

A Streamlined Structure

The list of initiatives for 1998-2000 reflects a significant change in CIP's project structure Prior to the ranking exercise, the number of projects was reduced from 36 to 20 (Of those 20, one was dropped during the priority-setting exercise, while five more were considered to perform "service" functions and did not receive rankings)

The new project structure, Walker believes, should help CIP improve the management of its scientific resources Projects will be more self-contained than they are at present, with teams of scientists united by—and accountable to—a single set of measurable goals Project leaders will have more control over project budgets, and more authority to make scientific decisions

"With the 36 projects used at present, monitoring, oversight, and reporting are extremely difficult," says Roger Cortbaoui, CIP's Director of International Cooperation and one of the architects of the new project system "Now there will be a person to whom we can go and say, 'Tell me how far we've gone toward achieving our goals'"

Cortbaoui says the new alignment is not revolutionary "It's an evolution The changes are based on our experience over the past several years—and our knowledge of what works and what doesn't"

CIP Research Projects 1998–2000

1. **Integrated Control of Late Blight**
2. **Integrated Control of Bacterial Wilt**
3. **Control of Potato Viruses**
4. **Integrated Management of Potato Pests**
5. **Propagation of Clonal Potato Planting Materials**
6. **Sexual Potato Propagation (TPS)**
7. **Postharvest Utilization of Potato**
8. **Analysis and Impact Assessment for Potato**
9. **Control of Sweetpotato Viruses**
10. **Integrated Management of Sweetpotato Pests**
11. **Propagation of Sweetpotato Planting Materials**
12. **Postharvest Utilization of Sweetpotato**
13. **Breeding for High Dry Matter in Sweetpotato**
14. **Analysis and Impact Assessment for Sweetpotato**
15. **Potato Production in Rice-Wheat Systems**
16. **Sustainable Land Use in the Andes**
17. **Potato Genetic Resources**
18. **Sweetpotato Genetic Resources**
19. **Andean Root and Tuber Crops Genetic Resources**

Color the Cañete Valley Environmental Yellow

A. SOLIMANO

Yellow cards and banners, coated with adhesives, are used in Peru's Cañete Valley to attract, catch, and kill the leafminer fly. The traps are part of a package of techniques designed to help growers protect their crops with a minimum amount of insecticides.

Two years ago in Peru's Cañete River valley, 150 kilometers south of Lima, hundreds of bright yellow plastic signs and cards began appearing in irrigated potato fields. At the same time, farmers could be seen carrying large rectangular yellow banners up and down the rows. Some people thought the farmers were protesting against an unknown but obviously unpopular government policy. Others thought they were practicing for an upcoming parade. The reality was quite different: the farmers were enrolled in a pilot program to control an insect pest that was reducing their potato yields by up to a third.

The cards and banners, coated with adhesives, were being used to attract, catch, and kill the leafminer fly, *Liriomyza huidobrensis*. The traps are part of a package of integrated pest management (IPM) techniques designed by CIP entomologists to help growers protect their crops with a minimum amount of insecticides.

Fausto Cisneros, head of CIP's IPM program, says that leafminer larvae damage crops by burrowing (or "mining") into the foliage. Adult females also do damage by puncturing the leaves to lay their eggs. First identified in Brazil in 1926, the insect is becoming an increasingly important pest worldwide.

Natural Enemies Fall

The leafminer became a major problem for Peru's coastal potato growers in the 1970s after massive doses of insecticides wiped out the fly's natural enemies. Norma Mujica, a CIP agronomist who is coordinating the pilot project with four farm organizations in the Cañete Valley, says that by the early 1990s, leafminer damage had reached a point where farmers were spraying extremely concentrated doses of insecticides up to 12 times per season

"As the spraying increased, the flies developed resistance to the insecticides, and secondary pests, chiefly white mites (*Polyphagotarsonemus latus*) and bud midges (*Prodiplosis longifila*), staged a comeback," Cisneros reports "Even worse, the tiny predatory wasps that helped keep leafminer flies under control had also fallen victim to the chemical cloud used against the potato moth "

Cisneros, whose research teams developed CIP's highly successful IPM programs for the potato tuber moth (*Phthorimaea operculella* and related species) and the Andean potato weevil (*Premnotrypes* spp), field-tested leafminer IPM in 1992 in the Tambo River valley in southern Peru with excellent results Participating growers reduced sprays from six to zero in two years Pilot projects were established in the Cañete Valley two years later under more severe fly infestation

A Balanced Attack

Cisneros says that the yellow cards and banners, first tested at CIP by Gaby Chávez and K V Raman in 1982, are just one component of the leafminer management program The traps are designed to lure and kill adult flies active in the early phases of the potato plant's growth, when they do the most damage

Meanwhile, the potato plant is contributing to its own defense by killing fly eggs deposited on its leaves This occurs as rapidly expanding plant tissue surrounds and squeezes the eggs from their nests This ejection process, which was first described in CIP's 1985 Annual Report, tapers off as the potato plant reaches maturity, and the eggs deposited late in the growing cycle hatch into larvae

Parasitic wasps (reintroduced as part of the IPM program) and one or two carefully timed sprays of insect growth regulators now team up to minimize damage As added insurance, CIP is field-testing potato clones with some resistance to the leafminer fly In addition, a new fly-

Cañete's IPM Pedigree

CIP's effort to combat the leafminer fly isn't the first time Cañete Valley farmers have tried IPM to counteract the effects of excessive pesticide use

From the 1920s to the 1950s, most of the irrigated farmland in the valley was devoted to large cotton plantations Beginning in 1949, the valley was repeatedly blanketed by DDT and other broad-spectrum insecticides to control cotton insect pests But despite stronger and more frequent doses, the pest problems persisted

It became clear that the insecticides had wiped out the natural predators of the cotton pests while the pests themselves had grown resistant to the chemicals. Meanwhile, a number of previously harmless insects had begun to take their toll on the crop.

Growers, working in partnership with private–sector researchers and Peru's Ministry of Agriculture, decided to ban all synthetic organic insecticides and to repopulate the valley with beneficial insects. The results were dramatic The pest problem abated, cotton yields soared, and production costs fell. The experience became a classic study in the success of integrated pest management.

Today, implementing IPM in Cañete is more complex There are more landowners and more crops, and decision-making is more decentralized But growers are still receptive. Potato farmer Mario Ortiz says that he used to watch with curiosity as a neighbor carried an oil-coated banner through his field. Now he has his own banner, to go with 140 standing traps.

"The plants are looking good, the flies have decreased, and we are saving money on insecticides," he says. "It is a good experience not only for us, but for farmers in general " resistant potato, María Tambeña, was released and is gaining favor with producers

Farmer Participation

Once a center for large-scale sugar cane and cotton production, the Cañete Valley is now the most intensively cultivated region in Peru, producing potatoes, maize asparagus, fruit, cut flowers, cotton, and other crops for the Lima market and for export With 23,000 hectares of mostly small- to medium-sized family farms under canal irrigation, it is also the most technologically advanced of the river valleys in Peru's coastal desert

Four agricultural organizations in Cañete are currently running pilot leafminer IPM projects in coordination with CIP They are the Instituto Rural Valle Grande, a nongovernmental organization, the Central de Cooperativas Agrarias-Cañete y Mala, a group of farmer cooperatives, the Estación Experimental de la Asociación de Agricultores de Cañete, an association of farmers, and the Instituto Superior Tecnológico Público de Cañete

CIP has presented guidelines for the deployment of the various IPM components, but nearly all the participating farmers are adapting the recommendations to suit their needs Whereas adhesive cards and banners were originally designed as alternatives to one another, some farmers are using both While CIP prototypes use imported plastic and chemicals, many growers are experimenting with local materials, such as inexpensive yellow plastic sheets coated with motor oil or fish oil, to reduce costs

Catching On

Daniel Flores and José Asato are each growing two hectares of the popular Tomasa potato variety Both are enrolled in an innovative work-study program run by the Instituto Rural Valle Grande In 1995, they sprayed four times to control adult leafminers at a cost of $200 In 1996, they devised a trap using two 12-meter by 1-meter yellow plastic sheets, coated with motor oil and mounted on the arms of a field spraying machine At the height of the adult fly season, Flores and Asato were netting about 90,000 flies with each pass of the sheets over the field

"We've already been able to cut the cost of production and the number of insecticide applications," says Flores Asato says that the potato plants are much healthier than they were at the same stage a year before "With selective sprays to control leafminer larvae, we should be able to top the 40 tons per hectare we produced last year," he says

Those results are good news for CIP's IPM team "For IPM to work, farmers must see it as a real alternative to what they are presently doing to protect their crops," Cisneros says "It is essential that we demonstrate under field conditions that they can reduce, and perhaps eliminate, environmentally dangerous insecticides while lowering production costs and maintaining or increasing yields "

"In-the-field evidence has a powerful psychological effect on farmers," adds CIP Director General Hubert Zandstra "It can spell the difference between the success or failure of an IPM program "

José Cose, who farms potatoes with his father Celso, agrees "I think the traps are becoming more accepted by farmers because they can see immediate results," he says "Farmers are very curious, and will quickly copy each other if they see proof that something is working "

A SOLIMANO

At the height of the adult fly season, farmers are trapping about 90,000 flies per trap. Shown here CIP entomologist Norma Mujica and Mario Ortiz of the Central de Cooperativas Agrarias-Cañete y Mala

Potatoes for Egypt: An IPM Success

Since the mid-1960s, Egyptian potato production has expanded at an annual rate of 5 percent, with production in 1995 estimated at 2 million tons. During roughly the same period, consumption increased from 8 to 32 kg per capita. These increases have taken place in a region where there is no appreciable rainfall, and where all farmland must be irrigated. Egyptian farmers till fewer than 3 million hectares, mainly in the Nile River delta. And it is here, unfortunately, where growth in potato production has been accompanied by huge increases in the use of highly toxic insecticides to control the potato tuber moth, *Phthorimaea operculella*.

Egyptian farmers have tried toxic pesticides to control the potato tuber moth in the past, but with disastrous results "Years of heavy pesticide use destroyed the balance between insect populations and their predators," explains Galal M Moawad, Director of Egypt's Plant Protection Research Institute "To make matters worse, tuber moths have developed insecticide resistance Even though farmers use higher pesticide concentrations, the effectiveness keeps diminishing"

The Egyptian government recently established strict controls on pesticide use, mainly to protect consumers It now prohibits the use of DDT and parathion on potatoes, and has begun to screen for detectable levels of pesticides on market potatoes In 1995, the health ministry intercepted a load of contaminated potatoes Sales dropped sharply and farmers were left with large amounts of produce they could not sell

IPM Safer, More Effective

Many delta potato farmers harvest two—and sometimes three—crops per year The most damaging pest in both seasons—in the field or in storage—is the potato tuber moth Its short reproductive cycle allows it to wreak havoc with the crop The adult tunnels through the soil and lays its eggs on the tuber's surface Larvae hatch 3 to 5 days later, then bore into the tuber

Within a week, the moth emerges as an adult, and the cycle begins again

Ramzy El-Bedewy, who heads CIP's Nile delta research station, argues that integrated pest management and biological control are more effective, safer, and less expensive than insecticides "There are many things farmers can do," El-Bedewy says "To make it more difficult for the moth to get at the tubers, farmers can hill the soil around the plants and keep the ground moist To limit exposure during the hottest months, when moth populations peak, they can plant in January and harvest in the early spring "

Judicious pesticide use can also be part of the mix, although El-Bedewy says that even pyrethroid-based products such as Decis and K-Othrine (deltamethrin), while less toxic to humans, still expose farmers to the "pesticide treadmill " A far better alternative is biological control

Over the past five years, the Plant Protection Research Institute and CIP have developed, tested, and released safe biological control agents to replace pesticides One of these is the granulosis virus (GV), which is specific to the tuber moth and kills no other insects Egypt's Plant Protection laboratory now manufactures GV-based sprays and powders that farmers claim work better than pesticides El-Bedewy says that the new products have been especially popular for protecting stored tubers

The Plant Protection laboratory has also found a strain of the soil-borne bacterium *Bacillus thuringiensis* (Bt) that is lethal to the tuber moth The lab multiplies Bt spores to make biological sprays and powders Biological control technology is so promising that the Egyptian government is reportedly investing US$1 million in a new production facility

"To use biological controls successfully, farmers have to change both their expectations and their practices," El-Bedewy says With conventional pesticides, farmers spray on a schedule regardless of the severity of the infestation With biological controls, they spray only when necessary, using pheromone traps to determine pest populations in the field

Whereas most pesticides kill on contact, GV and Bt sprays can take days Trainers help farmers understand what to expect in on-site demonstrations "Otherwise, farmers don't trust the recommendations," El-Bedewy says "But once they see that something works, they will go ahead and use it They don't need to wait for the results to appear in a scientific paper "

"I didn't think this would work," one farmer said during a training session "But now that I've tried it, I can see that it's better " Another farmer agreed "Even if it costs as much, it works better, and it's better for our health "

According to El-Bedewy, farmer demand is pushing biological control in Egypt "Farmers know that the technology works, and now they have confidence in using it," he says "They are the real force behind the change "

True Seed: Impact in Egypt

Despite intensive competition from overseas seed companies, Egyptian potato producers have made important gains in developing domestic seed supplies that use true potato seed (TPS), the tiny botanical seed produced by the flower of the plant (*see page 24*). A recent impact case study conducted by scientists from the Egyptian Ministry of Agriculture, the United Kingdom Overseas Development Administration, and CIP shows that investments in TPS will provide $51 million in benefits to Egyptian potato producers by the year 2015. According to CIP economists, Egypt's TPS project, begun in 1977, has produced a respectable internal rate of return (i.e., annual net benefits to farmers) of 28%, and has a net present value of nearly $3 million. On the plus side, these figures do not take into account health and environmental benefits associated with growing locally produced adapted seed that carries disease resistance and can be planted with fewer chemicals. Nor does the study consider the dangers of moving live potato tubers across international borders. On the minus side, economic benefits from the project are jeopardized by market liberalization policies, which increasingly make cheaper and potentially hazardous imported seed a reality.

Taming the Late Blight Dragon

In a single generation, farmers in developing countries have increased their share of world potato production from 10 percent to roughly one-third. But those gains are now being threatened by a resurgence of late blight, the same disease that triggered the Irish potato famine in the 1840s.

Late blight is caused by the fungus *Phytophthora infestans*, whose name comes from the Greek for "plant destroyer" It is difficult to exaggerate its effects Because late blight is spread by wind-borne spores, the disease moves quickly through potato-growing regions, often devastating an entire crop Within days, healthy fields can be rendered useless

CIP pathologist Edward R French calls late blight "the most dramatic of all plant diseases Under extreme conditions, it's like a dragon spewing flames, burning everything to the ground" A British writer in 1845 described the disease as "a fearful malady a great calamity that we must bear"

Imperfect Solutions

For poor farmers, little can be done once late blight strikes For decades, farmers in the North and large-scale growers in developing countries have relied on fungicides, with some spraying as many as 35 times per season CIP estimates that developing-country farmers spend US$100 million per year on chemical controls That figure, however, does not include environmental and health costs

The fungicides used to control late blight are not only potentially hazardous and expensive, but they are also losing their potency In many places, *P infestans* has developed resistance to the leading fungicides Meanwhile, newer and more virulent strains of the fungus have evolved to overcome genetic resistance in potato varieties themselves According to CIP estimates, late blight already reduces global potato production by 15 percent—a loss of $2 75 billion a year in developing countries alone

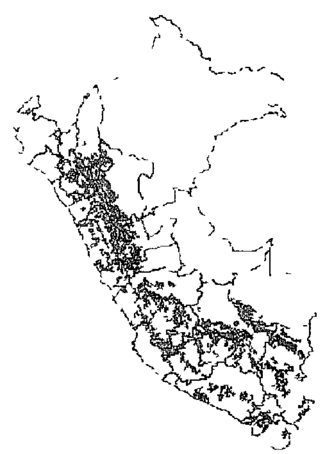
In 1996, CIP intensified its response to the late blight crisis by convening a worldwide network of potato researchers under the banner of the Global Initiative on Late Blight (GILB) Once fully funded, GILB will be a ten-year, $25 million effort Roughly equal portions of the funds will be shared among research institutions in developing countries, institutions in developed regions, and CIP (GILB received the formal endorsement of the CGIAR's Technical Advisory Committee in March 1997)

The Search for Durable Resistance

At GILB's initial meeting in March 1996, 53 participants from 19 nations in Africa, the Americas, Asia, and Europe gathered to set priorities At the top of their list was the develop-

Geographic information systems (GIS) technology is contributing to CIP's research on integrated disease management of late blight. GIS incorporates spatial information on agricultural production, historical data on weather patterns, and data generated by simulation models. The first two maps presented here show (1) Peru's potato production zones and (2) areas with potential for late blight. The third map (3) combines the data to identify production zones at high risk for late blight damage. GIS has also been used to design a scheme for collecting samples of *Phytophthora infestans*, the fungus that causes the disease. Current GIS research on late blight aims to characterize geographic differences in the disease system, assess production risks, and forecast the impact of new technology and resistant cultivars.

Potato production



Legend

Low **Medium** **High**

"In the case of late blight, we are dealing with a diverse crop, a diverse pathogen, and a wide range of environments," says CIP plant pathologist Rebecca Nelson. "Farmers can help make sense of the complexity."

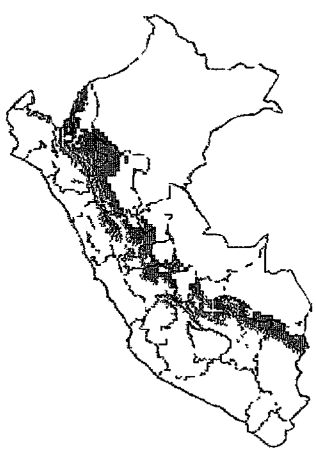
ment of built-in late blight resistance that can be used in integrated management programs by farmers around the world

Genetic resistance is not a new approach to fighting late blight For many years, plant breeders sought and exploited what is known as "vertical" or "qualitative" resistance to control the disease Vertical resistance relies on a specific gene in the potato plant (called an "R gene") that matches and resists a particular strain of the pathogen

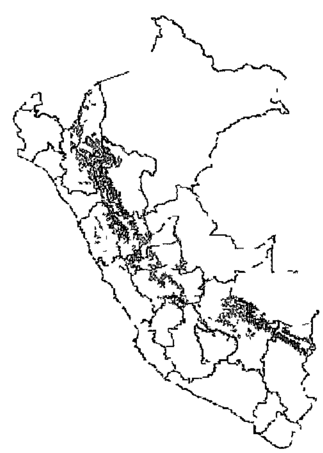
At first, the results of such breeding efforts were impressive, particularly when numerous R genes were incorporated into plants and vertical resistance was complemented with effective fungicides But as the pathogen has evolved, and as new strains have migrated from place to place, formerly resistant plants have suddenly become vulnerable Merideth Bonierbale, head of CIP's Breeding and Genetics Department, says that vertical resistance can actually force pathogens to evolve more quickly than they naturally would Thus the history of vertical resistance is a history of booms and busts

Another type of resistance, "horizontal" or "quantitative" resistance, seeks to make the

Potential late blight severity



High risk of production loss



system more stable by using multiple "minor" resistance genes in combination. "You can think of the disease as a thief holding a ring of keys," explains CIP breeder Juan Landeo. "If a door has just a single lock—even if it's a very strong one—it doesn't take long before the thief finds the right key and comes inside. But if the door has a large number of locks, it takes much more time to find the combination."

Bonierbale says that the goal is not to create plants with total immunity to the pathogen, but to keep the disease at bay long enough to avoid damage to the crop. "That way there is less pressure on the fungus to evolve more virulent strains."

Breeding for horizontal resistance is no simple matter, however. Creating a new potato variety normally takes about seven years, from identifying likely parents to testing tens of thousands of progeny. One way to speed up the process is through biotechnology. Marc Ghislain, a CIP molecular biologist, says that his laboratory has made progress in mapping the genes that provide resistance to late blight, a key step toward using them more efficiently. Classical plant breeding, he says, takes years to come up with answers. "We just don't have that kind of time."

Managing the System

As part of the late blight initiative, CIP and cooperating institutions are studying the interactions that occur between potato genotypes and the environments in which they grow. The "Genotype by Environment" study was started in 1995 by pathologists William Fry of Cornell University and Greg Forbes of CIP's Quito research station. The G x E study, which now involves ten scientists working under the GILB umbrella, is assessing horizontal resistance in South America, Europe, and North America. Initial data indicate that resistance has stability among sites. If this early trend holds up, it could mean that a given resistant variety may be useful in many environments throughout the world.

CIP scientists and their partners in GILB know, however, that breeding is only part of the solution to the late blight threat. "It's unlikely that durable resistance alone will do the trick," says Peter Gregory, CIP's Deputy Director General for Research. "We hope to provide farmers with a variety of defenses, with resistance at the center." Those other defenses involve the use of disease-free planting materials, the judicious application of pesticides, and the adoption of cultural practices conducive to controlling the spread of the late blight fungus.

A crucial component of any disease management system is the farmers themselves. GILB emphasizes the farmers' role not just in absorbing new technology, but in conducting research as well. "We are dealing with a diverse crop, a diverse pathogen, and a wide range of environments," says CIP pathologist Rebecca Nelson, who will be heading the Center's late blight project. "A relatively small team of scientists can't be expected to cover all that ground. Farmers can help make sense of the complexity."

"GILB is a pro-active effort, and should yield very tangible results," says CIP Director General Hubert Zandstra. "We can look forward to dramatically reduced expenditures on pesticides, billions of dollars in savings on crops that would be lost, and a stronger potato research infrastructure in developing countries where the crop is of vital importance."

The GILB Steering Committee

William Fry
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Plant Viruses: Hard to Detect, Harder to Control

Viral diseases can be as challenging for researchers as they are for farmers. Potato yellow vein disease, for example, has tormented potato farmers in Ecuador and Colombia for more than 50 years, causing tubers to wither and cutting yields by as much as half. But scientists are still not sure what causes it.

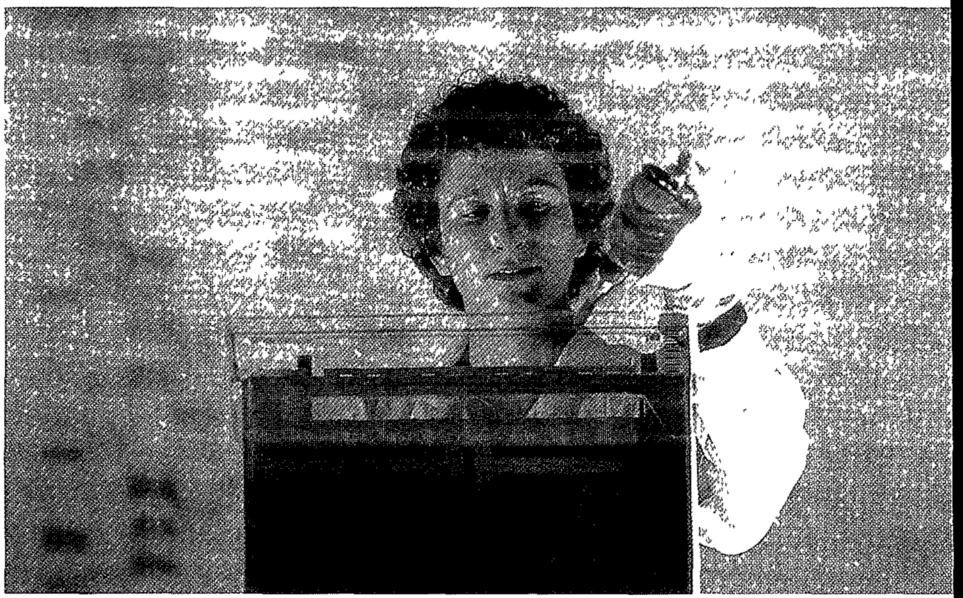
Luis F. Salazar, a CIP virologist and leader of the Center's Disease Management Program, says that yellow vein is transmitted by whiteflies (*Trialeurodes vaporariorum*) and is probably caused by a virus. "From a practical point of view," he says, "until we identify the pathogen and learn how it spreads, we will not be able to control it."

As with many virus diseases, yellow vein presents complex problems for researchers Salazar thinks the disease originated in weeds or vegetables, most probably carrots It seems that all potato tubers coming from infected plants carry the virus, although some tubers may not develop symptoms Nevertheless, offspring propagated from those apparently healthy tubers carry the disease

The disease is particularly damaging in those parts of Colombia where potatoes and beans are intercropped, and spreads most quickly where intensive insecticide use has wiped out the whitefly's natural predators Salazar says that the increased popularity of intercropping has made the yellow vein problem more acute, an example of what can happen when new technologies are introduced without considering their impact on pests and diseases

Breeding for Virus Resistance

Because virus-infected potato plants cannot be cured, as is the case for potatoes infected with fungi or bacteria, strategies for virus disease control must focus on preventive measures such as the use of resistant varieties, the control of insect vectors, and the detection and elimination of contaminated plants and seed Potato farmers frequently buy seed grown at higher elevations or in isolated locations that are relatively free of viruses and the insects that transmit them But poorer farmers cannot always purchase seed Nor do companies that export seed to developing countries normally breed for virus resistance



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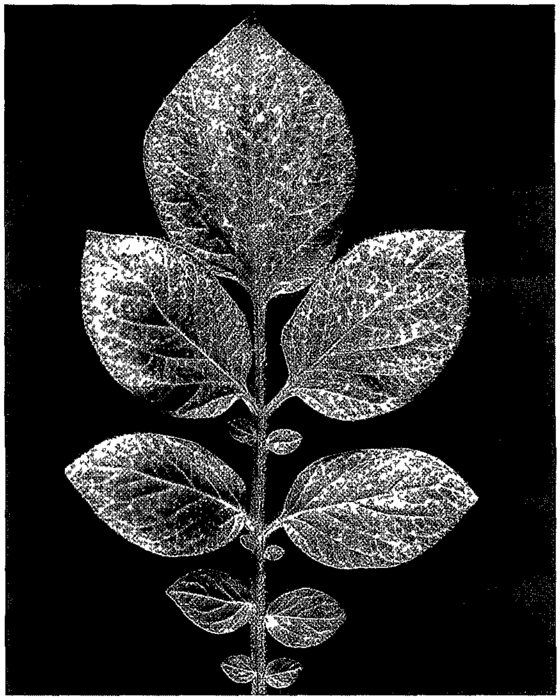
Maddalena Querci, a CIP molecular virologist who leads the Center's potato virus research project, expects cloned genes with resistance to potato virus X and Y to appear in CIP advanced breeding lines within three years.

Breeders and virologists at CIP are working to incorporate virus resistance into new varieties Indeed, some virus resistance is now available in about a fourth of CIP-bred genotypes The goal is to combine resistance to the three most common of the more than 25 known potato viruses potato leafroll virus (PLRV), potato virus X (PVX), and potato virus Y (PVY) PLRV and PVY are the most widespread and are responsible for significant crop losses

Mapping Virus X and Y Nearly Complete

From 1997 through 2000, CIP plans to spend US$8 7 million, or about 10 percent of its research budget, on potato virus control Another $2 7 million will be devoted to sweetpotato virus research "Virus research," says CIP Director General Hubert Zandstra, "is as sophisticated as it is costly It is also an area where the Center is trying to fill a gap left by the private sector Our experience is that seed companies are not eager to provide developing-country farmers with virus-resistant varieties "



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Potato yellow vein disease (symptoms above) has tormented potato farmers in Ecuador and Colombia for more than 50 years, causing tubers to wither and cutting yields by as much as half. But scientists are still not sure what causes it.

Zandstra notes that case studies on the interaction between potato plants and potato leafroll virus, the most damaging of the potato viruses, are helping CIP researchers discover different types of genetic resistance mechanisms in potato species. The studies have shown that some genes act on virus multiplication, whereas others affect the transmission of the virus by aphids. By combining these genes, CIP breeders have developed genotypes that have resisted infection by PLRV through seven years of field trials.

CIP virologists are collaborating with scientists at the United Kingdom's Sainsbury Laboratory to locate and label major resistance genes for potato virus X and potato virus Y through the use of molecular markers. The virus X resistance gene has been mapped at the Sainsbury lab and is currently being cloned, while work toward the mapping and screening of the Y resistance gene continues at CIP and at Sainsbury. Maddalena Querci, a CIP molecular virologist who leads the Center's potato virus research project, expects the cloned genes to appear in CIP varieties and advanced breeding lines within three years.

CIP virologists are also studying the potato spindle tuber viroid (PSTVd), one of more than a dozen plant viroids that were originally believed to be viruses that carry unusual characteristics. PSTVd causes deformed, spindle-shaped tubers, and can significantly reduce yields in susceptible cultivars. PSTVd has also been found to interfere with the plant's resistance to leafroll virus. PSTVd is normally transmitted by physical contact between plants and through true potato seed, but CIP virologists recently learned that it can also be transmitted by aphids from plants infected with PLRV.

The Sweetpotato Challenge

Virus research at CIP is not restricted to work on potatoes, however. For example, sweetpotato virus disease (SPVD) is receiving increasing attention due to its impact on resource-poor farmers in sub-Saharan Africa. SPVD is caused by the synergism between the aphid-borne sweetpotato feathery mottle virus (SPFMV) and a whitefly-borne virus (WBV). It is currently the Center's top priority for virus research in sweetpotato.

In recent years, CIP researchers developed cultivars resistant to SPFMV, but the plants were found to be susceptible to sweetpotato virus disease. Resistance genes for WBV are being sought in gene bank accessions, but work on developing transgenic resistance using DNA recombination may be required should this effort fail to uncover a natural form of resistance.

Resistance breeding is not the only defense against viral diseases of the sweetpotato. Because planting materials quickly become infected in the field, stocks must be renewed frequently, thus increasing the cost of production. The addition of virus resistance, it is believed, will allow poor farmers to use their seed for longer periods of time.

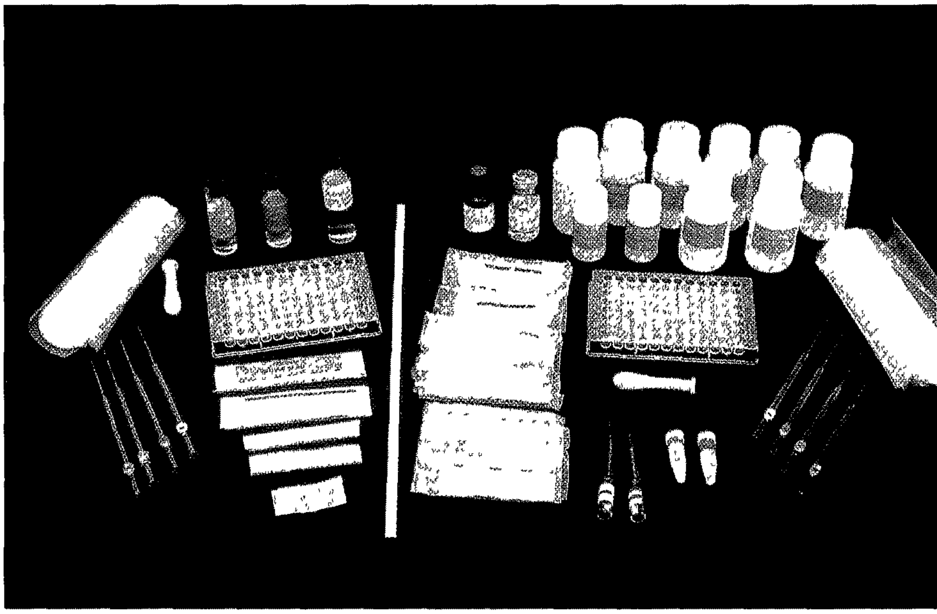
Indeed, the use of healthy planting materials is a highly effective control measure for SPVD. In China, the world's largest producer of sweetpotato, field experiments demonstrated that virus-free planting materials yielded two to three times more than those infected with the virus. The Shandong Academy of Agricultural Sciences has estimated that over an area of more than 70,000 hectares, farmers' yields increased an average of 35% following the introduction of healthy planting materials.

"Our work with sweetpotato viruses is particularly exciting for us," notes Salazar, "as it involves some of our most upstream research on a crop that addresses the concerns of some of the world's poorest farmers and consumers With some comparatively minor fine-tuning on the virology side, we should be able to help farmers realize more of the yield potential of this naturally high yielding commodity"

Detection Kits Made Simple

Virus detection is the most important component of virus control When CIP's virus research program began in 1972, scientists relied on indicator plants and visual observation of virus symptoms CIP virologist Luis F Salazar was part of a group of about 25 investigators who developed a serological virus detection technique in the mid-1970s The enzyme-linked immunosorbent assay (ELISA) remains the most sensitive detection method in use, allowing scientists to determine both the presence of a particular virus and its concentration

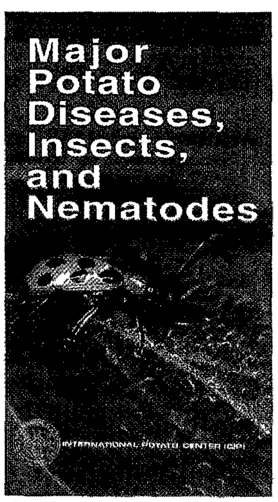
CIP has produced large numbers of user-friendly, low-cost ELISA kits, and distributed them throughout the developing world Meanwhile, researchers continue to develop more powerful and less expensive kits The use of these simple mobile laboratories in tuber seed production and research is now routine around the globe

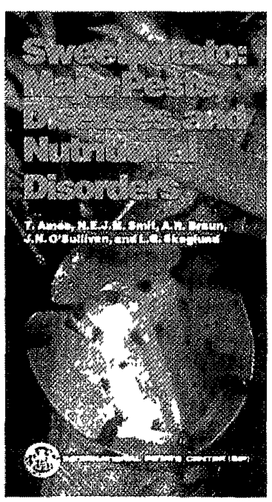


R MEDINA

CIP has produced large numbers of user-friendly, low-cost virus detection kits (above), and distributed them throughout the developing world. The use of these simple mobile laboratories in tuber seed production and research is now routine in many countries

Potato and Sweetpotato Pest and Disease Guides





CIP recently published field guides for identifying the major pests, diseases, and abiotic stresses for potato and sweetpotato. The full-color guides, originally printed in English, are suitable for copublication and are currently being translated into Spanish, Bahasa Indonesia, and Vietnamese. CIP field guides can be purchased for US$10.00 plus $5.00 for airmail delivery and handling (developing-country readers deduct 40% from the purchase price) by contacting the CIP Bookstore, Apartado 1558, Lima 12, Peru. Purchase orders may also be sent by e-mail to: cipbookstore@cgnet.com.

Think Globally, Act Locally: The Key to Success for India's True Potato Seed Program

CIP INDIA

According to postharvest surveys, over 90 percent of the farmers in West Bengal who tried TPS minitubers wanted to keep planting them Farmers said that it cost much less to plant minitubers, that yields were higher, and that the plants resisted late blight.

"I did not know what true potato seed was," said S.K. Bardhan Roy. That was in 1992. Roy had just joined West Bengal's Directorate of Agriculture, assigned to run Anandapore Farm, a research station 100 kilometers south of Calcutta. Four years later, Anandapore Farm was a major producer of true potato seed, the tiny botanical seeds that can be planted in the place of costly tuber seed.

Potatoes are typically produced from tubers Cut them up, or plant them whole, their offspring will be genetically identical to the tubers from which they came But the potato plant, a close relative of the tomato, also produces fruits that contain true seeds, or, as purists call them, botanical seeds These true seeds can be harvested, processed, and planted

Andean farmers were the first to use true seeds, also known as TPS There is evidence in Andean folk history that highland farmers used TPS to periodically clean their planting stocks and boost production Today, modern plant breeders use true seeds to produce improved varieties The process involves hand-pollinating the female parent with pollen from a selected male parent The results are berries the size of small tomatoes each of which contains hundreds of true seeds The technique yields tiny amounts of seed sufficient for breeding purposes, but not for commercial production

India: A World Leader in TPS

In India, farmers produce some 20 million metric tons of potatoes annually, making it one of the world's top potato producers Between 1961-63 and 1991-93 India's potato production increased from an average of 2 8 million metric tons to 15 7 million Farmers managed this without TPS, but most of the gains came from added potato area rather than from higher yields

The key to higher yields is the quality of the planting material that farmers sow When they start with poorly stored, diseased, or damaged tubers, yields drop dramatically Making sure that there is enough good tuber seed to go around is the core of a successful potato production program This is easier said than done, however, especially in tropical India, with its long, hot monsoon summers

To keep potatoes from one season to the next, seed tubers must be refrigerated in cold-storage warehouses These multistoried, cement-block buildings are found all over northern India, wherever potatoes are produced in quantity But how good is the planting material kept in a warehouse? Frequently, not very good Most consists of tubers farmers recycle from one crop to the next To plant just a hectare, farmers require from 2 to 2 5 metric tons of recycled tubers

The advantage of TPS, Roy believes, is its potential to free farmers from dependence on traditional seed systems in which disease-free tuber seed stock is multiplied at selected research stations This material, called "foundation" seed, then goes to state programs for additional multiplications At the end of the chain, which includes multiplications on contract, comes certified seed, which is sold to farmers By then, tuber quality is highly variable In any case, less than 10 percent of the potato stocks farmers plant annually consists of certified seed

TPS: One Step Removed

"TPS technology is ideal for West Bengal," Roy says, "because good tuber seed is hard to come by Farmers get their seed stocks from Uttar Pradesh, most of it through private dealers, there is no guarantee as to quality or varietal purity "

But in West Bengal, as elsewhere in India, TPS is not used to directly produce a commercial potato crop TPS is still one step removed from its final, farmer-friendly form the minituber, which *is* directly produced from TPS Minitubers, which are grown in seedbeds, range in size from small peas to cherries, but produce plants that are equal to those grown from large tubers derived from the highest-quality seed sources

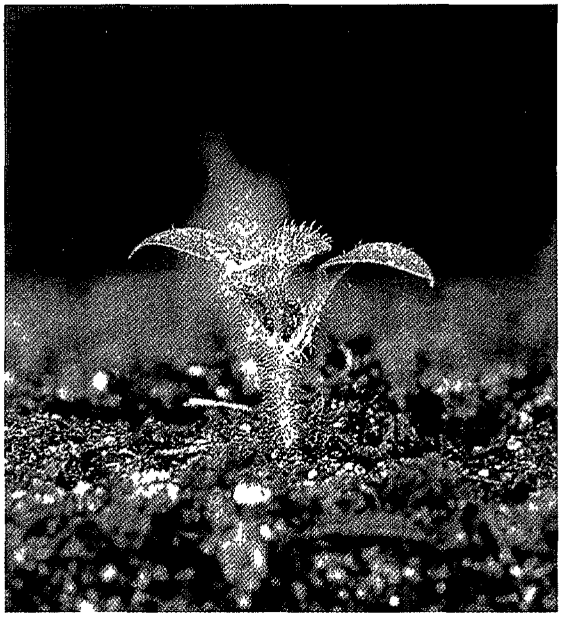
In 1995 the Anandapore Farm, one of six facilities set up by India's Ministry of Agriculture to produce TPS and TPS seedling tubers in West Bengal, produced 6 tons of minitubers from 1 kilogram of TPS A kilogram of minitubers costs no more than a kilogram of conventional, certified seed That gives TPS minitubers a tremendous advantage For yield, what matters is a tuber's quality and age, not its size

Parentage also counts The female parent Roy used, MF-I, was developed by M D Upadhya and K C Thakur, breeders at CIP's regional office in New Delhi, in collaboration with Indian potato farmers S N Bhargava and his son Arvind For the male parent, Roy used TPS-13, also developed at CIP-Delhi Disease-free planting stocks for both parents were produced at the Central Potato Research Institute's research station in Uttar Pradesh

TPS Production Tops 10,000 Hectares

To convince local farmers, whose holdings rarely exceed half a hectare, West Bengal's extension service has distributed TPS minitubers to some 150 farmers in five districts of the state The result potato yields from minitubers reached 32 metric tons per hectare, much higher than the 24 tons averaged by *Kufri Jyoti*, the favorite local variety

According to the extension service's postharvest surveys, over 90 percent of the farmers who tried TPS minitubers wanted to keep planting them Farmers said that it cost much less to plant minitubers and that yields were higher Their experience confirmed that a crop of TPS minitubers resisted late blight, a trait the genetic makeup of TPS minituber progeny reinforces With TPS, each seed produced, and each plant generated from a seed, is genetically distinct So when late blight tries to spread from plant to plant, it has to overcome the genetic barriers built into each



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A potato seedling emerging from a true seed, shown here at a scale of 3:1

Because of this genetic variability, anyone can spot a field of TPS-generated plants, for the height, bushiness, and leaf configuration of each plant is somewhat different Nonetheless, the size, color, and shape of the tubers developing underneath the plants are uniform Only farmers who harvested too early complained about tuber size To reach maturity and, hence, general uniformity, minitubers need just 90 to 100 days When left in the ground for that period of time, the TPS potatoes harvested are comparable in size to the popular *Kufri Jyoti* variety

For many farmers, however, the key advantage is flexibility A TPS minituber is only one multiplication old, which makes it much younger than either certified seed or farmers' recycled seed Once the minituber-generated crop is mature, farmers can sell it or hold the tubers as seed stock to replant The tubers so retained are now full-sized, but they are still younger and more vigorous, and have greater disease resistance than their conventional rivals. Farmers who plant minitubers get dependable, first-generation, high-quality seed at a reasonable price.

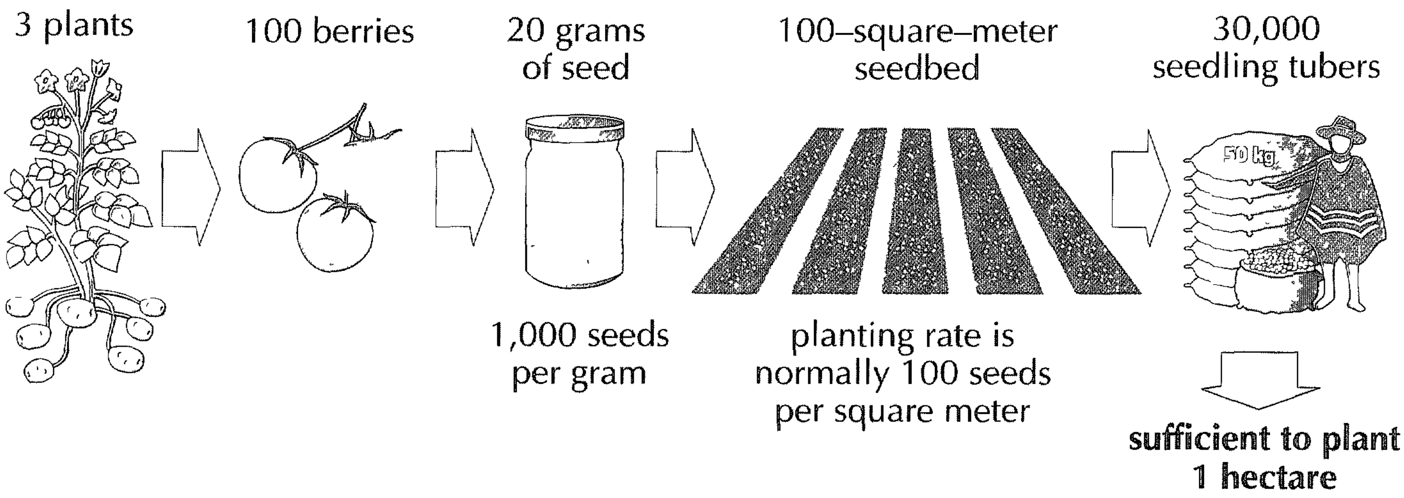
"The first step," Roy said, "is to accustom farmers to minitubers, the next step is to show them how to produce their own minitubers from TPS."

Further north, in the states of Uttar Pradesh and Haryana, farmers have already taken Roy's "next step." Four years ago, Jagbir Singh Mann and his wife Sarla Mann, potato farmers in Haryana state, got 5 grams of TPS. From this, they grew minitubers. Now they have 15 hectares of potatoes descended from their original minituber crop. And they are not alone. India's farmers currently have more than 10,000 hectares of TPS-generated minitubers and potatoes under production. With the multiplier effect, that total is expected to mount quickly. Asked if the marketing quality of his minituber-generated potato crop was good enough, Jagbir replied, "If it wasn't, I wouldn't have so much of it." He is now growing minitubers to sell to other farmers. For the 1996-97 crop, he sowed some 400 grams of TPS in his seedbed, harvesting enough minitubers to cover 3.5 hectares.

A decade ago, critics thought mass production of TPS was not feasible. They were wrong. A decade ago, critics thought TPS-generated potatoes would vary too much in shape, size, and color to be marketed commercially. Wrong again. What made for success was the healthy give and take between upstream research centralized at CIP and the downstream problem-solving approach of national and local programs. Without such cooperation, the critics would be the winners and West Bengal's small potato farmers the losers.

M. HIDALGO

TPS Arithmetic



This illustration traces the process required to generate enough seedling tubers to plant 1 hectare of potatoes from just 20 grams of true potato seed (TPS). The arithmetic involved is as simple as it is elegant. Potato plants produce berries that contain true seeds. One gram of TPS contains 1,000 tiny seeds. Twenty grams of TPS is sufficient to plant a seedbed 100 meters square. This 100-square-meter seedbed produces 30,000 seedling tubers that weigh approximately 500 kilograms, enough to plant 1 hectare. That is a far cry from the 2.5 metric tons of conventional seed tubers required per hectare.

Chacasina: True Seed in the Andes

In Peru's mountainous Callejón de Conchucos, 300 kilometers north of Lima, potato farmers are growing crops that produce an average of 45 tons per hectare, roughly three times the national average, and on a par with commercial yields in the United States and Europe. What's more, they have done it despite an extended drought and a late blight epidemic.

The farmers' success is largely due to a true potato seed (TPS) hybrid known locally as Chacasina. Selected in 1993 by CIP scientist Rolando Cabello, Chacasina incorporates the highly prized culinary qualities of its traditional-type female parent, Yungay, with the high productivity, early maturity, and late blight resistance of its CIP breeding line parent.

Yungay was originally developed in the 1950s by Carlos Ochoa, a CIP taxonomist and plant explorer. Adapted to highland conditions, Yungay grows well in poor soils and is tolerant of drought and mild frost. Consumers appreciate its creamy color and melt-in-your-mouth texture. Its major drawback is its susceptibility to late blight. Moreover, as with most Andean potatoes, the quality of its seed deteriorates quickly—a major problem for cash-poor farmers who tend to put off buying new planting materials until yields are unacceptably low.

CIP economist Hugo Fano says that the Callejón de Conchucos is typical of many high-altitude Andean environments. Infrastructure is basic at best. Drought is the rule rather than the exception, and plant diseases are a constant threat. Farmers have little money to invest in agricultural inputs, and much of what they grow they consume themselves. Yet farm families are extremely quality-conscious. "Throughout the Andes, the most important consideration is flavor," Fano says. "Chacasina doesn't just produce higher yields—people also like it."

Instead of reserving two tons from every hectare of harvested potatoes for use in the next planting, farmers who grow TPS hybrid Chacasina can plant just 300 kg—and get higher yields than with conventional varieties.

In Search of Seed

CIP's involvement in the region began in 1992, when an Italian priest, Hugo De Censi, came to Lima from the drought-plagued town of Chacas in search of potato seed to bring back to his hungry parish. As in many potato-growing communities, Chacas farmers lacked seeds to plant after four years of severe drought. In response, Cabello provided De Censi with a bag of TPS from a white-fleshed variety called Gringa, then quickly set to breeding what would come to be known as Chacasina. When the new variety was ready, Cabello and other CIP scientists helped the parish begin producing sexual seed for itself.

The new cultivar differs from other TPS because its parents can be cross-pollinated naturally as they grow side by side in the field to produce uniform true seed. This is possible because its mother, Yungay, is male-sterile and its CIP father is a prolific pollen producer.

In 1995, with financial help from the government of Peru and the United States Agency for International Development, CIP decided to deepen its commitment. This enabled the parish to build seedbeds, nurseries, and warehouses—not just in Chacas, but also in five nearby provinces. By the end of 1996, Chacasina was being grown in 11 test plots and more than 100 farmers' fields. "The farmers adapt much more quickly than the scientists do," says Fano. "They see what needs to be done and they go out and do it."

Results have been more than encouraging. "Local farmers are accustomed to harvesting between 3 and 10 kg of potatoes for every kilogram of seed potatoes they plant," Fano says. "With Chacasina—which is planted in the form of small minitubers—yields have been between 20 and 42 kg per kg of seed." Instead of reserving two tons from every hectare of harvested potatoes for use in the next planting, farmers can plant just 300 kg—and get much higher yields. That's on top of the fact that Chacasina seed is about half the price per kg of the other high-quality seeds available on the market. After just two years, the project is virtually paying for itself.

"This year, we're not getting any seed from outside," reports Edmundo Egúsquiza, a Chacas schoolteacher who is helping coordinate the project. Egúsquiza says the community hopes to produce at least 200 kg of TPS in 1997, enough for more than 4,000 hectares—far more than what is needed.

Questions Remain

For CIP scientists, several questions still need to be answered. Noel Pallais, who heads the project, says that it remains to be seen how many generations of seed potatoes Chacasina will produce before the quality deteriorates beyond usable levels. And while few people in the Callejón de Conchucos turn up their noses at the quality of Chacasina, consumer preferences in other Andean regions differ. The evidence indicates that similarly robust hybrids—matching local tastes and needs—can be produced for these areas.

Farmers trained in traditional farming methods also need to learn how best to take advantage of the new technology. Recognizing this, in September 1996, scientists from CIP, Peru's Ministry of Agriculture (INIA), and the National Agricultural University at La Molina presented a series of workshops in Chacas and other towns covering TPS production to fertilizer and water management.

"In the town of Llamellín, two farmers were so happy with the course that they cried at the end," says Rolando Cabello. "One of the priests who helped organize the workshop told us that what we had done came from heaven, that it was something supernatural."

Edmundo Egúsquiza is a religious man, but his assessment is more down to earth. "Now we have a stock of seed," he says. "It's good to know that we are protected if anything should happen."

Editor's Note. Regrettably, in March 1997 something did happen. A priest assigned to the project was killed by an unknown gunman. Reliable sources believe that the tragedy was not the act of terrorists. Ironically, the 1997 harvest of TPS—some 300 kg of seed—may have equaled the annual record set by commercial TPS producers in other parts of Latin America and in Asia. Reliable sources indicate that the Chacasina project will continue in the future without outside assistance.

UPWARD: Asian Network Bringing Users into Research Process

A long-standing complaint against agricultural science is that it often imposes solutions from above. One CIP initiative addresses that criticism head-on.

On the Philippine island of Mindanao, researchers are working with rural women to increase the contribution of home gardens to the biodiversity of an upland watershed. In the process, they are enhancing soil fertility and improving household food security. In Indonesia, farmers and scientists are conducting experiments on integrated crop management of sweetpotato, building on successful experiences with other crops.

Both projects are sponsored by Users' Perspectives with Agricultural Research and Development (UPWARD), which brings together scientists from various disciplines with farm families, traders, processors, and consumers. Participants apply their experience and expertise to a problem-based agenda. The network, established in 1990 and funded by The Netherlands, is coordinated from CIP's liaison office in Los Baños, Philippines.

UPWARD has supported nearly 50 projects in six Asian countries, with research topics ranging from crop production and genetic resources conservation to processing and marketing. Network coordinator Gordon Prain, a CIP anthropologist, says that the projects have not only helped scientists and users make headway on critical issues in agricultural research, but they have also led to a better understanding of Asian root crop agriculture and food production systems in general.

"By paying close attention to how the systems really work, we can learn substantially more about achievable options for improvement," he says.

Taking the Less-Traveled Path

Dindo Campilan, assistant UPWARD coordinator, says that the projects have served as a vehicle for testing a variety of user-participatory methods and tools. Scientists share experiences and evaluate their research in light of their interaction with local users. These discussions also provide a basis for academic debate on more general approaches to agricultural research and development.

Gelia T. Castillo, former CIP Board Chair and Professor Emeritus at the University of the Philippines at Los Baños, notes that UPWARD has chosen a complicated and difficult course. "But perhaps it is time to venture onto less-traveled paths in more marginal areas and in less-favored crops," she adds.

Castillo, who is senior advisor to UPWARD, contends that the traditional transfer of technology is undergoing a transformation. More and more, she says, scientists are listening to farmers and learning from their practices. This is reflected in the growing importance of gender analysis, the use of traditional landraces in improved crop varieties, farmer participatory breeding, the incorporation of social and economic data when characterizing ecosystems, on-farm research and conservation, and the development of farmer-tested methods for integrated pest, nutrient, and water management.

C. PRAIN

On the island of Mindanao, UPWARD researchers are working with rural women to increase the contribution of home gardens to the biodiversity of an upland watershed. In the process, farmers are enhancing soil fertility and improving household food security.

Local Control

Proponents of the UPWARD approach believe that the results are often more profound than those produced by more traditional research systems In Jingning county in China's Zhejiang province, for instance, researchers, extension workers, and farmers together evaluated a number of options for boosting potato production and expanding the area under cultivation (*see following story*) Those involved in the project say that the cooperative approach helped transform potato into a cash crop in that area

In the Terai region of eastern Nepal, researchers and potato farmers have jointly undertaken on-farm trials to test both indigenous practices and research-generated technologies for integrated management of late blight disease They have found that adjusting planting dates, changing some cultivation practices, and adopting improved potato varieties allow farmers to reduce fungicide use while keeping late blight under control More work is being done to explore ways to avoid losing stored potatoes to pests and diseases

On the northern coast of Vietnam, farm families are working with local development agencies and national researchers to adapt sweetpotato as a novel raw material for starch and noodle processing By using sweetpotato starch, in combination with the more traditional starch made from the Andean canna root (*Canna edulis*), farmers have improved product quality and increased profitability by reducing raw material costs

Prain notes that researchers have long used farmers' and consumers' ideas to identify problems and refine research agendas For the last six years, UPWARD has gone one step further incorporating users in the research process itself Now, he says, it is time for governments and institutions to make the user-perspective approach standard operating procedure and bring agricultural research and development more under local control

Users' Perspectives With Agricultural Research and Development

UPWARD Project Reduces Poverty in China

Poor farmers in the southern mountains of China's Zhejiang province traditionally relied on upland potatoes in the winter months for both food and livestock feed. Under mandatory quota systems, however, they were compelled to grow winter wheat, even though heavy rains made the region unsuitable.

That changed with the economic reforms of the late 1980s, when growers were given more freedom to select their crops. In Jingning county, enterprising farmers at lower elevations began replacing winter wheat with potatoes, timing harvests to have tubers in the markets when demand and prices peaked.

At the same time, field trials carried out by provincial and local research scientists showed that when potatoes were grown before rice in paddy fields, yields of both crops rose substantially The improvement was especially marked at higher elevations, where most paddy fields remained fallow following the rice crop

Enter UPWARD

Those events coincided with the establishment of the UPWARD network As one of its initial projects in 1991, UPWARD began assessing options for increasing potato production in the rice-based cropping systems in Zhejiang province Work focused on Jingning county, one of Zhejiang's poorest areas

In line with the network's goal of reducing poverty, the project sought to boost food production and raise household incomes Likewise, project activities were designed to tap the skills and energies not just of researchers and extension workers, but of farmers, consumers, and policymakers The goal was to jointly develop and test technology innovations appropriate to the real needs of the people in the project area

The principal researcher was Zhang Rentian of the Zhejiang Academy of Agricultural Sciences, located in the provincial capital of Hangzhou, 400 kilometers north of Jingning The project was coordinated by Wu Jianhua of the Jingning Bureau of Agriculture Both hoped that improvements in potato production in Jingning county would eventually spread throughout Zhejiang

Major Changes in Production

They appear to have been right While production of other winter crops has declined steadily, potato production has grown dramatically Zhang and Wu estimate that provincial potato production expanded by 40 thousand tons (more than 9 thousand tons in Jingning alone), whereas revenues increased by US$3 7 million during the first five years of the project They say that much of the increase can be traced to project activities, which involved

- Convincing farmers and local leaders of the value of growing potatoes in predominantly rice-growing areas,
- Introducing technology to shorten the potato-growing season (e g , early-maturing varieties, plastic ground covers, improved row design, and changes in the timing of fertilizer applications),
- Improving the quality and health of potato seeds,
- Conducting (in cooperation with the local government) more than 350 training sessions for more than 18,000 farmers, and
- Producing and distributing training guides

Dramatic Impact on Poverty

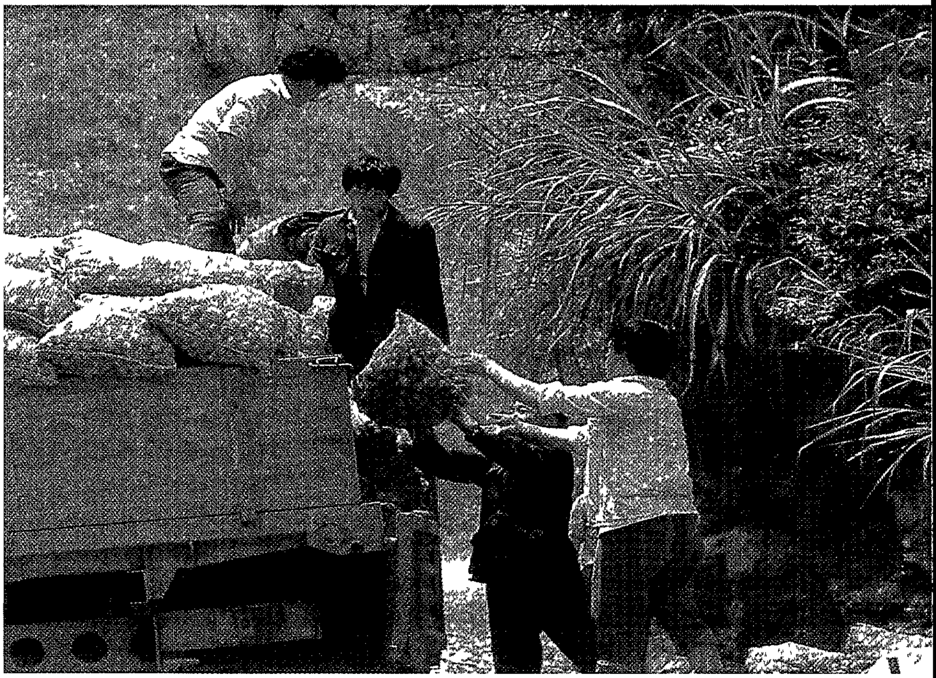
"What makes the project so impressive is not the speed of its development," says Gelia T Castillo, UPWARD senior advisor "It is the dramatic impact on reducing poverty in one of the poorest counties in the province "

In Jingning county, the planted area of paddy-field potato rose from 200 hectares to 2,000 hectares, thus effectively transforming a cereal-based farming system into a potato-centered one The effect on household incomes has been impressive In one target village, 12 farm households each planting one-sixth of a hectare of potatoes in 1996 boosted their net annual earnings to $609—more than eight times the average yearly income of county farmers in 1995

In upland areas, income gains can be indirect, Zhang says At elevations above 300 meters, farmers tend to use about half of their potato harvest to feed pigs, thus increasing their family protein intake and generating manure for fertilizer for other crops Above 800 meters, planting potatoes has boosted rice yields by as much as 20 percent, combining the two crops, annual food production per land area can more than double

Seed multiplication and supply have been long-standing problems for Zhejiang potato farmers The UPWARD project evaluated 45 varieties from other parts of China, and screened and introduced four for local use These were planted by more than 300 households in 1996 and are being multiplied for 1997 Meanwhile, the preferred local variety, Mongolia Big Potato, is being field-purified and multiplied for seed in the high mountains, where disease pressure is less intense Zhang says that the preference of lowland farmers for highland seed is a boon for highland farmers

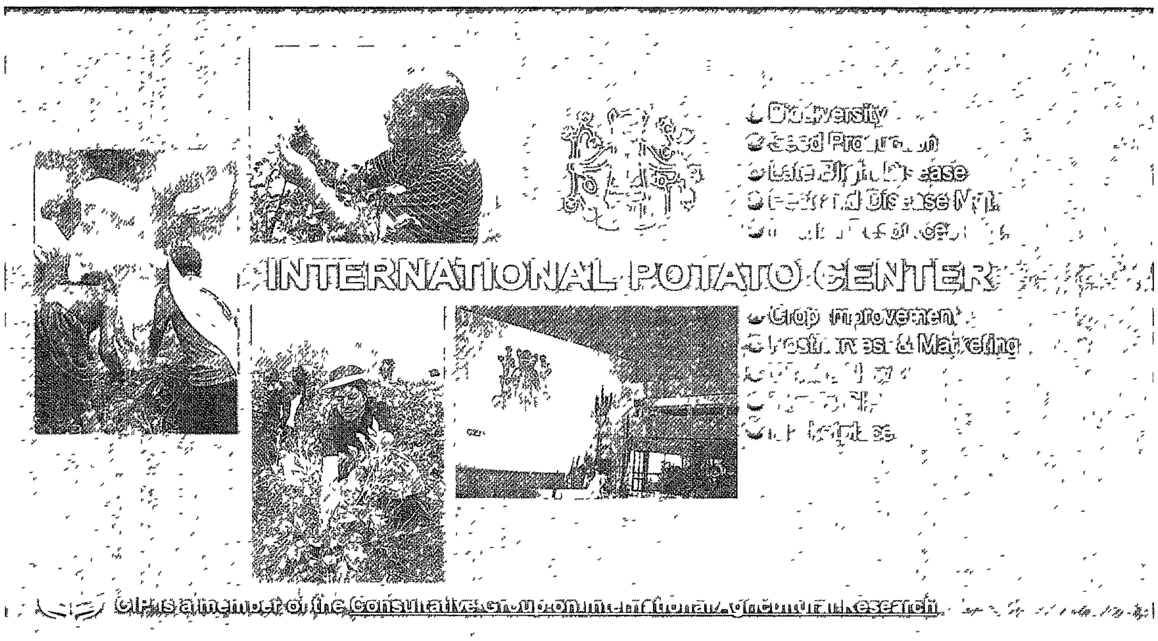
Castillo describes the project's achievement as a "confluence of many factors, none of which by itself can explain success All the components—policy, ecosystems, technologies, markets, training, applied research, and local institutional involvement—seem to have come together "



G PRAIN

In China's Jingning county, the planted area of paddy-field potato rose from 200 hectares to 2,000 hectares, thus effectively transforming a cereal-based farming system into a potato centered one. In one target village, farmers boosted net annual earnings to $609, more than eight times the average yearly income of other local farmers.

On-Line: http://www.CIPotato.org



CIP's home page on the World Wide Web is the front door to the Center's Web site, located at http://www cipotato.org The home page provides connections to extensive, up-to-date information about the Center's crops, research programs, and regional and training activities Designed for use by diverse groups of Center stakeholders, the home page allows users to guide themselves to files ranging from basic information about potato history to complex scientific and technical data The home page also includes full-text copies of CIP's impact case studies. Over time, the Web site will be updated to expand user access to other publications and to Center research and bibliographic databases

Information Technology: Compatibility, Performance, and Savings

In 1996, financial, logistics, and e-mail systems were migrated to the new NT systems architecture, which was established in 1995 to achieve substantial cost savings and performance benefits. With NT servers also operational at PROINPA in Cochabamba, Bolivia, and CIP-Quito, all key regional offices should have computer systems compatible with CIP-Lima in 1997. The CIPFIS financial management system (*see pages 34-35*) was the first to take advantage of CIP's global systems compatibility.

This first year of operations of the CGIAR integrated voice and data network (IVDN) has provided headquarters with improved e-mail performance, substantial cost savings on international telephone and FAX calls, and fast, on-line access to the Internet. Timely access to international databases now benefits both scientific and administrative staff in Lima.

CIP continues to strongly support the SINGER project (the CGIAR's Systemwide Information Network for Genetic Resources). In April 1996, CIP became the first CGIAR center to give the international community access to data on germplasm via the Internet and World Wide Web. In May, two staff members presented CIP's fully operational prototype system at a SINGER training workshop held in Africa.

Board of Trustees

A. SOLIMANO

Finance and Administration

CIP's 1996 income totaled a record $26 3 million, 6% above 1995 figures Of the total income for the year, the Center received $22 1 million (84%), a figure that includes $1 5 million in other income The accounts receivable balance was $4 2 million (16%)

The Center has been gradually rebuilding its reserve account, which reached $1 1 million at the end of 1996, an increase of nearly 30% over 1995 The Center was able to continue doing this through savings in operating expenses

CIP uses a centralized cash management system, which integrates all Center cash transactions, including those at headquarters and at regional and liaison offices The system optimizes cash available for operations and short-term investment, thus reducing borrowing Although $4 2 million is receivable from contributions pledged for 1996, cash flow improved compared with 1995, and recourse to credit lines remained steady at fewer than 25 days

Operational expenses by activity (%) for 1996 and 1997 (estimated).

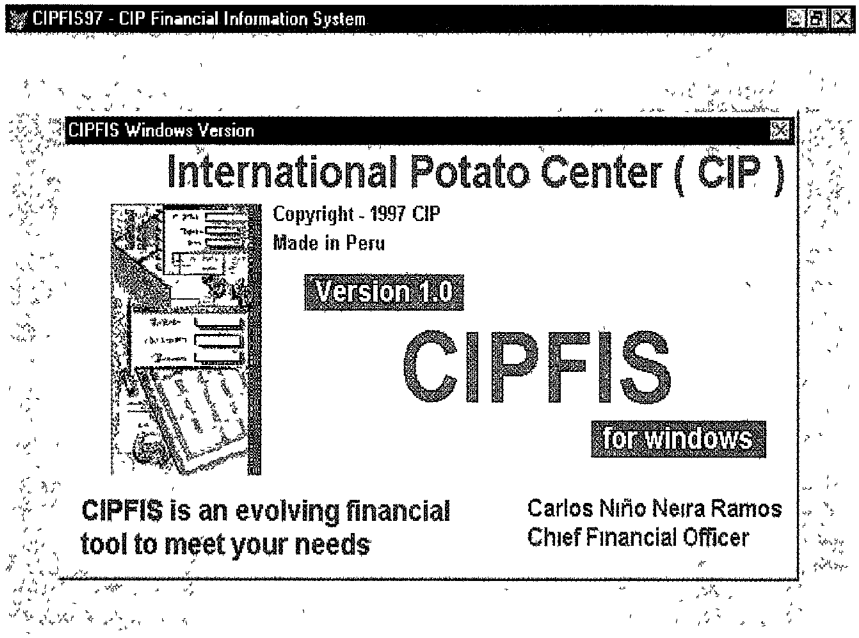
Area	1996	1997
Research	70	71
Training	5	5
Information	3	3
Administration	8	8
General Services	10	9
Depreciation	3	3
Operating Fund	1	1
Total	100	100

Balance Sheet (US$000)

	1996	1995
	Year ended 31 December	
Current Assets		
Cash and short-term deposits	6,501	4,347
Securities	81	89
Accounts receivable		
Donors	3,485	3,873
Employees	388	404
Other	292	219
Inventories	863	845
Prepaid expenses	998	1,350
Total	12,608	11,127
Investments	483	572
Loans to employees	379	335
Fixed Assets		
Property, plant, and equipment	21,365	20,674
Less accumulated depreciation	(11,502)	(10,976)
Total	9,863	9,698

The table below summarizes CIP's finances in 1996. A complete, audited financial statement by Coopers & Lybrand is published separately, and can be requested from the Chief Financial Officer at CIP headquarters in Lima, Peru.

On-line 24 hours a day, 365 days a year, the CIP Financial Information System (CIPFIS) provides research managers and administrators with immediate access to current budget status from headquarters or from the Center's regional locations. The system, developed at CIP to increase operational efficiency and optimize cash management, has proven highly effective.



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Balance Sheet (US$000)	**1996**	**1995**
	Year ended 31 December	
Current Liabilities		
Short-term loans	414	393
Advances from donors	5,834	5,049
Accounts payable		
Research contracts and organizations	1,554	1,317
Suppliers and taxes	1,010	972
Provisions for severance indemnities	52	64
Total	8,864	7,795
Long-term Loan	515	686
Accruals and Provisions	672	443
Net Assets		
Capital invested in fixed assets	9,863	9,698
Capital fund	2,341	2,332
Operating fund	1,078	778
Total	13,282	12,808

Donor Contributions in 1996

DONOR (ranked by levels of contribution in US$000)	UNRESTRICTED & RESTRICTED	NON-AGENDA
Swiss Agency for Development and Cooperation	4,638*	505
European Commission	1,900	
Germany–BMZ/GTZ	1,626	
World Bank	1,600	
Inter-American Development Bank	1,590	
Japan	1,400	
United States Agency for International Development	1,347	300
Netherlands	1,249	
United Kingdom Overseas Development Administration	1,080	
Swedish International Development Cooperation Agency	1,038	
Danish International Development Agency	999	
Canadian International Development Agency	803	
Australia–ACIAR	662	
International Development Research Centre	529	11
Belgium	512	
Austria	425	
United Nations Development Programme	370	
International Service for National Agricultural Research	290	
Luxembourg	250	
France	241	
Asian Development Bank	232	
Norway	139	
Islamic Republic of Iran	100	
China	90	
Korea	60	
Spain	50	
International Centre for Research in Agroforestry	45	
India	37	
OPEC Fund for International Development	27	
Weizmann Institute of Science	25	
Ministerio de Economía y Finanzas (Peru)		466
International Fund for Agricultural Development		57
Food and Agriculture Organization of the United Nations		50
ILEIA (Information Centre for Low External Input and Sustainable Agriculture)		50
Natural Resources Institute		45
International Plant Genetic Resources Institute		40
CARE Perú		26
USAID/Centro Internacional de Agricultura Tropical		9
USAID/University of Georgia		5

*Includes $2 7 million in network and country research projects

Staff in 1996

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George Mackay, MS, Director of Genetic Resources[2]

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Production Systems
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Germplasm Management and Enhancement
Ali Golmirzaie, PhD

Disease Management
Edward French, PhD (until April)
Luis F Salazar, PhD (since May)

Integrated Pest Management
Fausto Cisneros, PhD

Propagation, Crop Management
Mahesh Upadhya, PhD

Postharvest Management, Marketing
Gregory J Scott, PhD

G CHANG

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(*country*) = post location, but activity regional in scope
country = post location

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Liaison Office—Ecuador
Charles Crissman, PhD

Sub-Saharan Africa (SSA)
Peter Ewell, PhD, Regional Representative (*Kenya*)
Liaison Office—Nigeria
Humberto Mendoza, PhD[4]

Middle East and North Africa (MENA)
Aziz Lagnaoui, PhD, Regional Representative (*Tunisia*)
Liaison Office—Egypt
Ramzy El-Bedewy, PhD

South and West Asia (SWA)
Sarathchandra Ilangantileke, PhD (*India*), Regional Representative

East and Southeast Asia and the Pacific (ESEAP)
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Liaison Office—People's Republic of China
Song Bo Fu, PhD
Liaison Office—Philippines
Gordon Prain, PhD

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Edward Carey, PhD, Breeder (*Kenya*)[4]
Enrique Chujoy, PhD, Geneticist (*Indonesia*)
Il Gin Mok, PhD, Breeder (*Indonesia*)
Haile M Kidane-Mariam, PhD Breeder (*Kenya*)[4]

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[1] Staff who joined during the year
[2] Staff who left during the year
[3] Staff funded by special projects
[4] Project leader

Genetic Resources

Ali Golmirzaie, PhD, Geneticist, Head of Department[4]
Carlos Arbizu, PhD, ARTC Consultant[3]
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Aziz Lagnaoui, PhD, Entomologist (*Tunisia*)
Nicole Smit, MS, Associate Expert, *Uganda*[3]
Jean Louis Zeddam, PhD, Entomovirologist

Pathology

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Edward R French, PhD, Bacteriologist[4]
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Maddalena Querci, PhD, Molecular Virologist[4]
Lod J Turkensteen, PhD, Adjunct Scientist, *Netherlands*

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Noel Pallais, PhD, Physiologist[4]
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Alwyn Chilver, MS, Associate Expert, *Indonesia*[3]
Charles Crissman, PhD, Economist (*Ecuador*)[4]
Peter Ewell, PhD, Economist (*Kenya*)[4]
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Jan Low, PhD, Economist (*Kenya*)[2,3]
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Julia Wright, MS, Associate Expert[2]

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Bill Hardy, PhD, English and Spanish Writer/Editor, Acting Head of Unit (until Sept)

Information Technology

Anthony Collins, MS, Head of Unit[3]

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Office of the Deputy Director General for Research

José Luis Rueda, PhD, Coordinator, Andean Natural Resources

Special Country Projects

FORTIPAPA, Ecuador

Albéric Hibon, PhD, Economist, Team Leader[2,3]

PROINPA, Bolivia

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Javier Franco, PhD, Nematologist[3,4]
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Carlos Niño-Neira, CPA, Controller

Office of the Executive Officer
César Vittorelli, Ing Agr , Acting Executive Officer

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Jorge Espinoza, MS, Agronomist
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Elisa Mihovilovich, MS, Biologist
Daniel Reynoso, MS, Agronomist

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Juan Cabrera, MS, Agronomist[1]
Manuel Canto, PhD, Nematologist[3,4]

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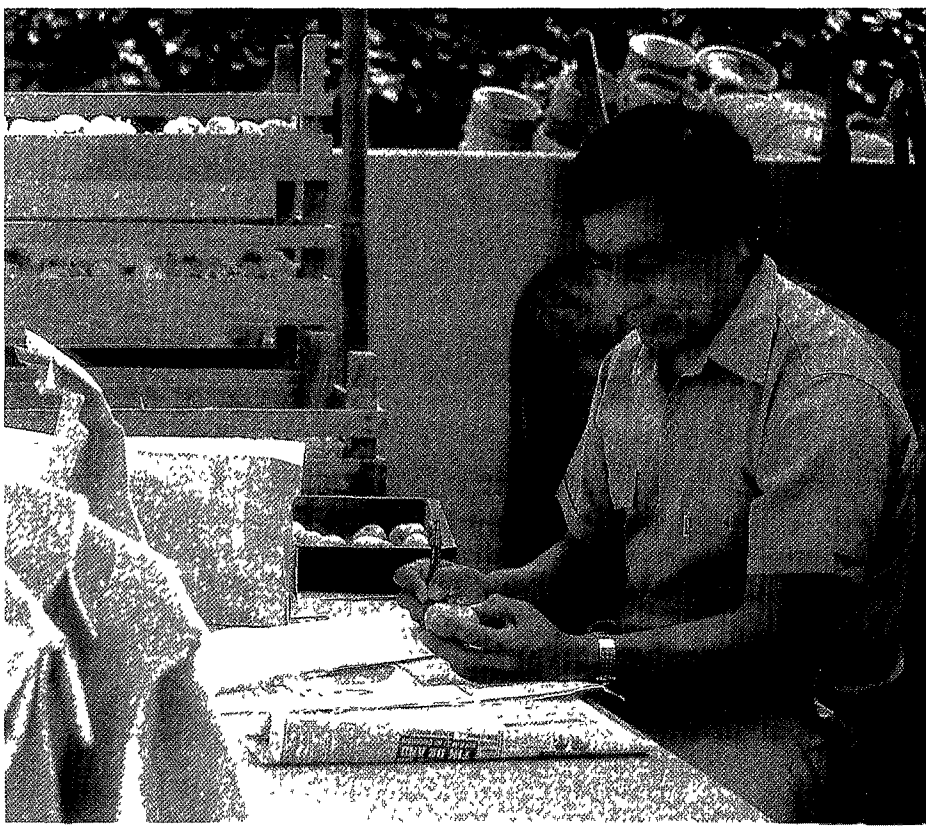

Verónica Cañedo, Biologist
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Oder Fabián, Ing Agr [2]
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Pía María Olіden, Systems Analyst
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Edgardo Torres, BS, Systems Engineer
Alberto Vélez, MS, systems Engineer

Library
Cecilia Ferreyra, Head Librarian

Controller's Office
Miguel Saavedra, CPA, General Accountant
Edgardo de los Ríos, CPA, Senior Accountant
Vilma Escudero, Accountant[2]
Milagros Patiño, BA, Accountant[1]

Accounting Unit
Jorge Bautista, Accountant
Blanca Joo, CPA, Accountant
Rosario Pastor, CPA, Senior Accountant
Eduardo Peralta, Accountant

Budget Unit
Denise Giacoma, CPA, Accountant
Alberto Monteblanco, CPA, Senior Accountant

Treasury Unit
Sonnia Solari, Chief Cashier

Office of the Director General

Visitors' Office
Mariella Corvetto, Supervisor

Office of the Executive Officer

Travel
Ana María Secada, Supervisor

Logistics and General Services
Aldo Tang, Comdr (ret), General Services Manager

Front Desk
Micheline Moncloa

Maintenance
Antonio Morillo, Chief

Purchasing Supervisors
Arturo Alvarez
Roxana Morales Bermúdez[2]
José Pizarro

Security
Jorge Locatelli, Capt (ret), Supervisor[2]

Transportation
Hugo Davis Paredes, Vehicle Maintenance Officer
Atilio Guerrero, Vehicle Programmer
Jacques Vandernotte, Pilot[2]
Djordje Velickovich, Pilot[2]
Percy Zuzunaga, Pilot

Warehouse
Jorge Luque, MBA, Supervisor

Human Resources
Lucas Reaño, Human Resources Manager
Juan Pablo Delgado, Human Resources Manager[2]

Auxiliary Services
Mónica Ferreyros, Supervisor
Sor Lapouble, Assistant

Compensation
Estanislao Pérez Aguilar, Supervisor

Medical Office
David Haltin, MD
Lucero Schmidt, Nurse

Social Work
Martha Piérola, Supervisor

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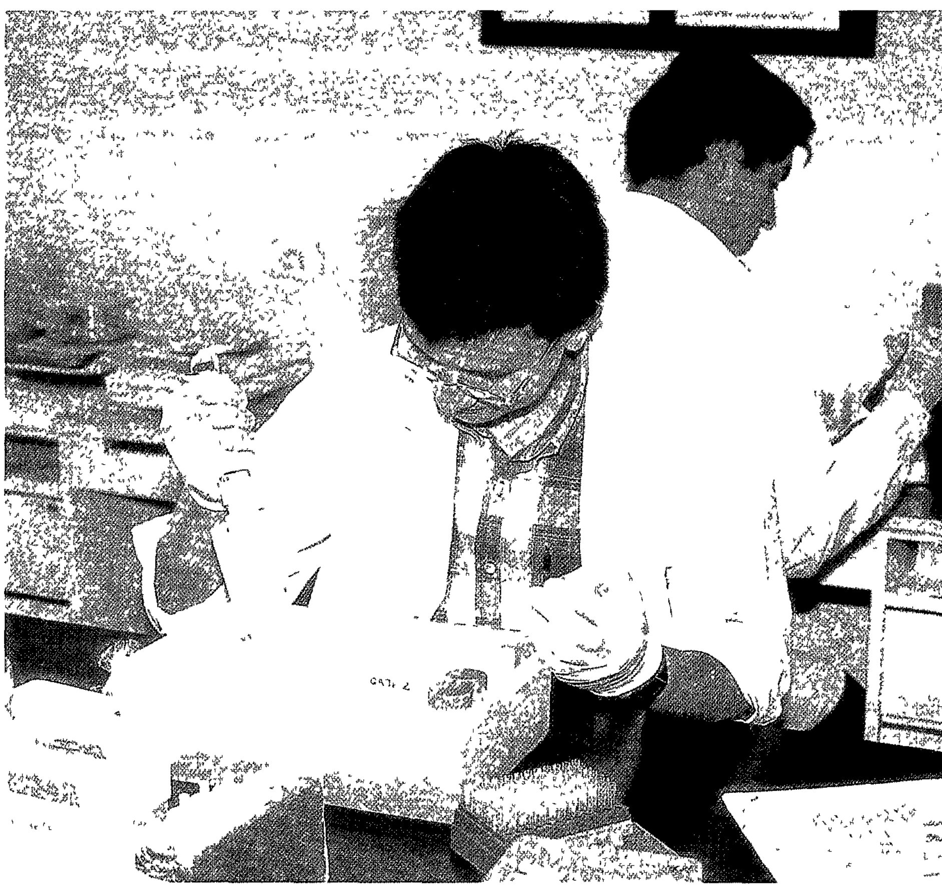


Selected Scientific Publications 1996

Austin, D.F. and Z. Huamán. 1996 A synopsis of *Ipomoea* (Convolvulaceae) in the Americas Taxon 45(1) 3-38

Blondet, C. and R.L. Durán. 1996 El impacto potencial de la difusión de tecnología panificadora de camote en panaderías de Villa El Salvador Documento de Trabajo no 1996-2, CIP, Lima, Peru 52 p

Bouis, H.E. and G. Scott. 1996 Demand for high value secondary crops in developing countries The case of potatoes in Bangladesh and Pakistan FCND Discussion Papers no 14 International Food Policy Research Institute (IFPRI), Food Consumption and Nutrition Division (FCND), Washington, D C , USA 46 p

Cabanilla, L.S. 1996 Sweetpotato in the Philippines Production, processing and future prospects International Potato Center, University of the Philippines, Lima, Peru/Manila, Philippines 100 p

Chávez, R., M. Upadhya, H. Mendoza, J. Espinoza, R. Cabello, P. Siles, G. Bollo, T. Meléndez, J. Eyzaguirre, C. Maquera, E. Guevara, K. Monasterio. 1996 Nuevas hipótesis y avances de selección en el mejoramiento genético de papa y camote para adaptación a suelos áridos y salinos Rev Consejo de Investigación (COIN), Ciencia y Desarrollo, Univ Jorge Basadre Grohmann (Perú) p 32-54

CIP. 1996 La batata en cifras Un compendio de información clave y análisis para 33 importantes países productores de batata, producción, uso, consumo y alimentación animal Lima, Peru v p

CIP. 1996 Sweetpotato facts A compendium of key figures and analysis for 33 important sweetpotato-producing countries, production, use, consumption, feed use Lima, Peru v p

CIP. 1996 Late blight A global initiative Lima, Peru 21 p

CIP. 1996 Principales enfermedades, nematodos e insectos de la papa Lima, Perú 111 p

Crissman, C. and A. Hibon. 1996 Establishing seed potato prices Concepts, procedures and implications for research and training Social Science Department Working Paper Series no 1996-1, CIP, Lima, Peru 24 p

Dayal, T.R., G.J. Scott, G.T Kurup, and C. Balagopalan (eds.). 1996 Sweetpotato in South Asia Postharvest handling, processing, storage and use (Proceedings of a workshop) Trivandrum, India, 9-13 Sept 1991 Central Tuber Crops Research Institute (CTCRI), CIP, Lima, Peru 137 p

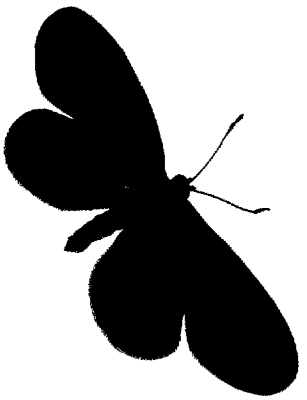
Díaz, J., P. Schmiediche, and D.F. Austin. 1996 Polygon of crossability between eleven species of *Ipomoea* Section *Batatas* (Convolvulaceae) Euphytica 88(3) 189-200

Estrada, R.D. 1996 Análisis ex post de la influencia de algunas variables macroeconómicas sobre la competitividad agropecuaria, equidad y conservación de recursos In Rivera, B and R Aubad (eds) IESA América Latina 1995 El enfoque de sistemas de producción y la incorporación de criterios de política Memorias 2 Simposio Latinoamericano sobre Investigación y Extensión en Sistemas Agropecuarios Santa Fé de Bogotá, Colombia, 7-9 Nov 1995 Corporación Colombiana de Investigación Agropecuaria (CORPOICA), Bogotá, Colombia p 219-230

Fano, H., O. Ortiz, and T. Walker. 1996 Peru Inter-institutional cooperation for IPM In Thrupp, L A (ed) New partnerships for sustainable agriculture World Resources Institute (WRI), Washington, D C , USA p 85-98

French, E.R. and G.R. Mackay (eds.). 1996 Enhancing the global late blight network Report of the project design meeting on the Global Initiative on Late Blight CIP, Lima, Peru 43 p

Fuentes, S., M.A. Mayo, C.A. Jolly, M. Querci, and L.F. Salazar. 1996 A novel luteovirus from sweet potato, sweet potato leaf speckling virus Ann Appl Biol 128(3) 491-504



This list includes selected journal articles, book chapters, and CIP publications. CIP staff made many other contributions such as invited papers presented at meetings and published in proceedings. CIP's Library can provide a complete list of publications generated by CIP in 1996.

Gibson, R.W., R.O.M. Mwanga, S. Kasule, S. Fuentes, and E.E. Carey. 1996 Sweet potato feathery mottle and other viruses in Uganda In Proceedings of the regional sweetpotato workshop Commission of the European Union, Technical Agricultural Center (TAC), Libreville, Gabon p 87-90

Gitomer, C.S. 1996 Potato and sweetpotato in China Systems, constraints and potential CIP/ Chinese Academy of Agricultural Sciences (CAAS), Lima, Peru 183 p

Golmirzaie, A.M. and L.F. Salazar. 1996 Application of biotechnology for conservation and utilization of Andean root and tuber crops and biosafety guidelines African Crop Sci J 3(3) 341-344

Gregory, P. 1996 Global program to develop late blight resistant potato cultivars CGIAR News 3(3) 1

Hagenimana, V., R.E. Simard, and L.P. Vezina. 1996 Method for the hydrolysis of starchy materials by sweetpotato endogenous amylases U S Patent no 5,525,154 June 11, 1996 11 p

Hijmans, R.J. and M.K. van Ittersum. 1996 Aggregation of spatial units in linear programming models to explore land useoptions Neth J Agric Sci 44 145-162

Holle, M. 1996 La biodiversidad es una de las bases del desarrollo sustentable In Rivera, B and R Aubad (eds) p 77-78 *

Jacobsen, S.-E., J. Hill, and O. Stollen. 1996 Stability of quantitative traits in quinoa *(Chenopodium quinoa)* Theor Appl Genet 93 110-116

Khatana, V.S., M.D. Upadhya, A. Chilver, and C.C. Crissmann. 1996 Economic impact of true potato seed on potato production in eastern and northeastern India CIP, Lima, Peru. 19 p

Mazón Ortiz, N., R. Castillo Torres, M. Hermann, and P. Espinosa. 1996 La zanahoria blanca o arracacha (*Arracacia xanthorrhiza* Bancroft) en Ecuador Publicación Miscelánea no 67 Instituto Nacional Autonómo de Investigación Agropecuaria (INIAP)/Dept de Recursos Fitogenéticos y Biotecnología (DENAREF)/CIP, Quito, Ecuador 41 p

Mendoza, H.A, E.J. Mihovilovich, and F. Saguma. 1996 Identification of triplex (YYYy) potato virus Y (PVY) immune progenitors derived from *Solanum tuberosum* ssp *andigena*. Am Potato J 73(1) 13-19

Mujica B., E. and J.L. Rueda S. 1996 El desarrollo sostenible de montañas en América Latina Actas de la segunda consulta regional intergubernamental sobre el desarrollo sostenible de montañas CONDESAN/CIP/FAO, Lima, Peru 318 p

Pallais, N., J. Santos-Rojas, and R. Falcón. 1996 Storage temperature affects sexual potato seed dormancy HortScience 31(1) 99-101

Programa Colaborativo Biodiversidad de Raíces y Tubérculos Andinos. 1996 Memorias 1994-1995 CIP/Cooperación Técnica Suiza (COTESU)/Consorcio para el Desarrollo Sostenible de la Ecorregión Andina (CONDESAN), Lima, Peru 370 p

Quirós, C.F., A. Epperson, J. Hu, and M. Holle. 1996 Physiological studies and determination of chromosome number in maca, *Lepidium meyenii* (Brassicaceae) Econ Bot 50(2) 216-223

Quiroz, R., C. León Velarde, B. Arce, and D. Genin. 1996 Resultados de ensayos en ganadería con modelos de simulación In Rivera, B and R Aubad (eds) p 113-123 *

Rivera, J.J. and R.D. Estrada. 1996 Cuantificación ex ante del intercambio entre equidad, productividad y sostenibilidad para el diseño de alternativas tecnológicas· El caso del cultivo de arracacha en Colombia In Rivera, B and R Aubad (eds) p 101-112 *

Rodríguez Quijano, P. 1996 La papa y el desarrollo económico en Colombia CIP/

* See the entry for Estrada, R D , for details on this publication

Corporación Colombiana de Investigación Agropecuaria (CORPOICA), Lima, Peru 114 p

Salazar, L.F. 1996 Potato viruses and their control Lima, Peru 214 p

Salazar, L.F. 1996 Aplicación de la microscopía electrónica en la virología vegetal In Castillo de Maruenda, E , N Rojas Morán, and A López Milla (eds) Microscopía electrónica en el Perú Consejo Nacional de Ciencia y Tecnología (CONCYTEC), Lima, Peru p 43-48

Scott, G.J. 1996 Paradoxes and projections for potatoes in the 1990s Entwicklung + Landlicher Raum 30(3) 20-22

Thiele, G., A. Devaux, and C. Soria. 1996 Innovación tecnológica en la papa De la oferta de tecnología al impacto macro-económico In Rivera, B and R Aubad (eds) p 79-88 *

Thro, A.M., R.N. Beachy, M. Bonierbale, C. Fauquet, G. Henry, G.G. Henshaw, M.A. Hughes, K. Kawano, C.J.J.M. Raemakers, W. Roca, C. Schopke, N. Taylor, and R.G.F. Visser. 1996 International research on biochemistry of cassava (tapioca, *Manihot esculenta* Crantz) and its relevance to Southeast Asian economies A Cassava Biotechnology Network review Asian J. Trop Biol 2(1) 1-30

Upadhya, M. 1996 True potato seed technology to fight potato blight in developing countries Diversity 12(3) 67-68

Upadhya, M.D., B. Hardy, P.C. Gaur, and S.G. Ilangantileke. 1996. Production and utilization of true potato seed in Asia CIP/Indian Council of Agricultural Research, Lima, Peru 233 p

Valdivia, R., E. Huallpa, V. Choquehuanca, and M. Holle. 1996 Monitoring potato and *Oxalis* varieties in mixtures grown on farm family fields in the Titicaca Lake basin, Peru, 1990-95 In Eyzaguirre, P and M Iwanaga (eds) Participatory plant breeding Proceedings of a workshop Wageningen, Netherlands, 26-29 July 1995 International Plant Genetic Resources Institute (IPGRI), Rome, Italy. p 144-150.

Van den Berg, J.H., E.E. Ewing, R.L. Plaisted, S. McMurry, and M.W. Bonierbale. 1996 QTL analysis of potato tuber dormancy Theor Appl Genet 93(2) 317-324

Van den Berg, J.H., E.E. Ewing, R.L. Plaisted, S. McMurry, and M.W. Bonierbale. 1996 QTL analysis of potato tuberization Theor Appl Genet 93(3) 307-316

Velit Tamanaja, E. 1996 Identificación de virus en papa (*Solanum tuberosum*) In Castillo de Maruenda, E , N Rojas Morán, and A López Milla (eds) Microscopía electrónica en el Perú Consejo Nacional de Ciencia y Tecnología (CONCYTEC), Lima, Peru p 75-80

Walker, T.S. and C.C. Crissman. 1996 Case studies of the economic impact of CIP-related technology Lima, Peru 157 p

Walker, T.S. and C.C. Crissman. 1996 Estudios de casos del impacto económico de la tecnología relacionada con el CIP en el Perú Lima, Peru 32 p

Watanabe, K.N., M. Orrillo, A.M. Golmirzaie, S. Pérez, J. Crusado, and J.A. Watanabe. 1996 Generation of pest resistance Diploid potato germplasm with short day adaptation from diverse genetic stocks Breeding Sci 46 329-336

Yencho, G.C., M.W. Bonierbale, W.M. Tingey, R.L. Plaisted, and S.D. Tanksley. 1996 Molecular markers locate genes for resistance to the Colorado potato beetle (*Leptinotarsa decemlineata*) in hybrid *Solanum tuberosum* x *S berthaultii* potato progenies Entomol Exp Appl 81 141-154

Zandstra, H.G. 1996 The CGIAR response to new challenges in agroenvironmental research in developing countries In Rivera, B and R Aubad (eds) p 335-342 *

Zandstra, H.G. 1996 Twenty-five years of international potato research, a retrospective and forward look Potato Res 39(4) 395-401

Core Research in 1996

Program, Project, and Activity	Locations and Partner Networks
Characterization of constraints and opportunities for potato production	
Farmer participation in clonal evaluation	• Bolivia
Characterization of potato production systems	• Ecuador • PRAPACE
Fate of soil conservation in the Andes	• Ecuador
Benchmark sites and database development	• Peru
Characterization of sweetpotato constraints and opportunities	
Sweetpotato characterization	• India • Southeast Asia • Sub-Saharan Africa
Users' Perspective with Agricultural Research and Development (UPWARD)	• Asia • China • Netherlands
Sustainability of sweetpotato cropping systems	• Uganda
Adaptation and integration of potato production technologies	
Varietal adaptation to diverse agroecologies	• Bolivia • Cameroon • Chile • China • Indonesia • Peru • Philippines • PRAPACE
Expanding production to new regions	• India
Adaptation and integration of sweetpotato production technologies	
Varietal adaptation to diverse regions	• China • Egypt • India • Indonesia • Kenya • Peru • SARRNET • Tanzania • Uganda
Evaluation of the impact and sustainability of potato production technologies	
Impact assessment and size of NARS	• Argentina • Bangladesh • Bolivia • Chile • China • Colombia • Dominican Republic • Ecuador • Egypt • Ethiopia • India • Indonesia • Kenya • Madagascar • Nepal • Peru • PRAPACE • Sri Lanka • Taiwan • Vietnam
Pesticides and sustainability	• Canada • Ecuador • USA

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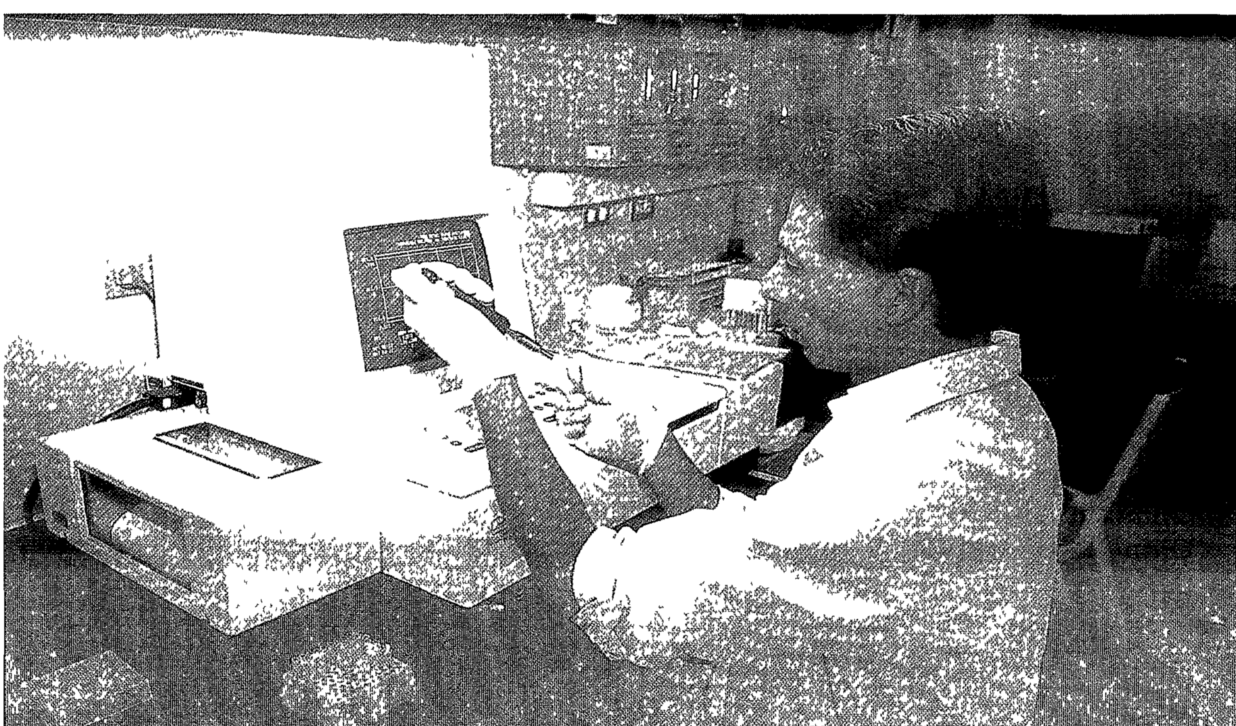


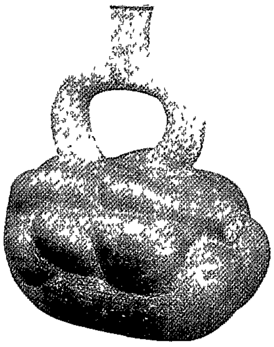
Program, Project, and Activity	Locations and Partner Networks
Potato collection and characterization	
Collection, characterization, conservation, and distribution	• Chile • Peru • USA
In vitro conservation	• Ecuador • Peru
Potato germplasm enhancement, application of molecular technology	
Germplasm enhancement	• Peru • USA
Application of molecular marker technology	• Argentina • Costa Rica • Ecuador • Germany • Netherlands • Philippines • UK • USA
Potato genetic engineering for pest and disease resistance	• Belgium • Bolivia • Peru • UK • USA
Sweetpotato collection and characterization	
Collection, characterization, conservation, documentation, distribution, and evaluation	• Argentina • Bangladesh • Brazil • China • Indonesia • Philippines–UPWARD,
In vitro conservation and virus eradication	• Austria • Peru • USA • Venezuela
Collection and evaluation of indigenous knowledge	• Indonesia–UPWARD
Sweetpotato germplasm enhancement and molecular techniques	
Combining traits using conventional techniques in diverse agroecologies	• China • East Africa (Kenya, Tanzania, Uganda) • Indonesia • Peru • USA
Utilization of wild relatives of sweetpotato	• Japan • Peru • USA
Molecular techniques for sweetpotato improvement	• Canada • China • Japan • Peru • USA
Andean root and tuber crop collection and characterization	
Germplasm management in farmers' fields	• Peru • Bolivia
Development of a network for ex situ conservation	• Ecuador • Peru • Bolivia • Brazil
In vitro conservation and distribution	• Ecuador • Peru • Bolivia
Pathogen eradication and seed production	• Ecuador • Peru • Bolivia
Commodity systems analysis	• Ecuador • Peru • Bolivia
Control of potato late blight (Phytophthora infestans)	
Breeding and screening for resistance	• Argentina • Bolivia • China • Colombia • Ecuador • Kenya • Mexico • Peru
Integrated control	• Bolivia
Fundamental host-pathogen research	• Ecuador • Kenya • Netherlands • Peru • Philippines • Scotland • USA
Integrated control of potato bacterial wilt	
Fundamental research for control strategies	• China • Colombia • England • Peru
Development of resistance	• Brazil • China • Indonesia • Mauritius

CIP's extensive research collaboration brings together many partners worldwide. This table summarizes CIP's core research activities in 1996, and the principal places and networks involved.

Program, Project, and Activity	Locations and Partner Networks
	• Nigeria • Peru • Philippines
Integrated control	• Burundi • Kenya • Peru
Combining resistances to potato viruses and fungi	
Development of virus- and viroid-resistant materials	• Peru • Poland • Tunisia
Interaction of potato viruses and fungi	• Peru • Philippines
Selection of combined resistance to viruses and fungi	• Argentina • Brazil • Cameroon • Central America and the Caribbean • Colombia • East Africa • Ecuador • Egypt • Nigeria • Paraguay • Peru • Philippines • PROCIPA • Uruguay • USA • Venezuela
Detection and control of potato viruses	
Resistance to PLRV	• Peru
Detection of viruses and viroids	• Bolivia • Colombia • India • Peru
Transmission of potato viruses and viroids	• Peru • Philippines
Identification of potato yellow vein disease	• Colombia • Peru
Identification and control of sweetpotato viruses	
Detection, identification, and eradication of viruses	• China • Peru
Integrated control	• Kenya • Madagascar • Rwanda • Tanzania • Uganda
Control of bacterial and fungal diseases of sweetpotato	
Resistance to diseases	• Southeast Asia • UK
Molecular approaches for detection and control of pathogens	
Genetic resistance and probe development	• England • Peru
Virology of Andean roots and tubers	
Detection and characterization of viruses	• Bolivia • Ecuador • Peru
Elimination of pathogens	• Peru
Production loss by viruses	• Bolivia • Ecuador • Peru
Potatoes with resistance to major insect and mite pests	
Development of resistant genotypes for potato tuber moth and leafminer flies	• Peru
Potatoes with glandular trichomes	• Peru • USA
Transgenic potatoes with insect resistance	• Belgium • Peru
Field evaluation of resistant plants	• Peru
Integrated methods for control of potato tuber moth and leafminer fly	
Generation of technologies	• Bolivia • Colombia • Dom Republic • Peru

Program, Project, and Activity	Locations and Partner Networks
Use of sex pheromones and granulosis virus	• Bolivia • Colombia, Ecuador & Peru–PRACIPA • Dominican Republic • Egypt • Tunisia
Applied field management	• Bangladesh • Bolivia • Colombia • Dominican Republic • Egypt • Kenya • Morocco • Peru • Tunisia • Venezuela • Yemen
Integrated methods for control of sweetpotato weevil	
Development of resistance	• Asia • Cuba • Kenya • Peru • USA
Use of sex pheromones	• Cuba • Dominican Republic • Uganda
Biological control	• Bangladesh • Cuba
Applied field management	• Cuba • Dominican Republic • Indonesia • Kenya • Philippines • Uganda
Integrated methods for control of sweetpotato nematodes	
Development of resistance	• Peru
Applied field management	• Peru
Integrated methods for control of Andean potato weevil	
Development of resistance	• Peru
Cultural and biological control methods	• Bolivia • Colombia • Ecuador • Peru
Applied field management	• Bolivia • Colombia • Ecuador • Peru
Integrated methods for control of potato cyst nematode and false root-knot nematode	
Crop rotation schemes	• Peru
Applied field management	• Bolivia • Ecuador • Peru
Propagation of healthy clonal potato planting materials in diverse agricultural systems	
Research support to in-country basic seed programs	• Bangladesh • Bolivia • Burundi • Cameroon • Colombia • Ecuador • Paraguay • Peru • Philippines • Uganda • Venezuela • West Africa
Sexual potato propagation	
Breeding for improved TPS families	• Argentina • Chile • China • India • Italy • Kenya
TPS agronomic adaptation to diverse agroecologies	• Bangladesh • China • Egypt • India • Indonesia • Italy • Morocco • Nepal • Nicaragua • Paraguay • Peru • Philippines • Sri Lanka • Tunisia • Vietnam
Studies on TPS production	• Bangladesh • Chile • India • Indonesia • Nepal • Peru
Sweetpotato production through improved management techniques	
Crop management practices	• Burundi • Cameroon • China • Peru • Philippines

Program, Project, and Activity	**Locations and Partner Networks**
Studies on tolerance of abiotic stresses	• Bolivia • China • Egypt • Peru • Philippines
Management of forage-type sweetpotatoes	• Peru
Maintenance, international distribution, and monitoring of performance of advanced potato germplasm	
Ongoing activities (seed units)	• Kenya • Peru • Philippines
Maintenance, international distribution, and monitoring of performance of advanced sweetpotato germplasm	
Ongoing activities (seed units)	• Kenya • Peru • Philippines
Abiotic stresses and potato crop management	
Breeding for improved tolerance of abiotic stresses	• Bolivia • Chile • Peru • Philippines • Southeast Asia
Agronomic research for potatoes grown under stress	• Egypt • Peru • Philippines • Uganda • USA
Propagation of Andean root and tuber crops and management of Andean natural resources	
Seed production, Andean root and tuber crops	• Ecuador • Peru
Management of Andean natural resources	• Peru
Expanding utilization of potato in developing countries	
Low-cost storage of table and seed potatoes	• India • Kenya
Potato breeding for processing	• India • Peru • Philippines • PRECODEPA • Tunisia
Marketing and demand for potatoes	• Bolivia • China • Colombia • India • Indonesia • Kenya • Morocco • Netherlands • PRECODEPA • Tunisia • UK • UPWARD • USA
Potato processing	• China
Product development for sweetpotato in developing countries	
Evaluation and distribution of elite sweetpotato materials for processing	• China • Indonesia • Kenya • Peru • Philippines • Uganda • USA • Vietnam
Marketing and demand for sweetpotatoes	• Argentina • ASPRAD • Bangladesh • China–UPWARD • India • Indonesia • Kenya • Malawi • Netherlands • Peru • Philippines–UPWARD • USA
Processing of sweetpotato	• ASPRAD • China–UPWARD • India • Indonesia' • Kenya • Malawi • Netherlands • Philippines • SARRNET • Tanzania • Uganda • UK • Vietnam
Postharvest management of Andean food commodities	
	• CONDESAN in Bolivia, Brazil, Colombia, Ecuador, and Peru



Training in 1996

Program and Title	Countries Represented	Partner Institution
Course on crop management and potato seed storage	Peru	MEF/CIP
International course on potato seed production	Argentina, Bolivia, Colombia, Costa Rica, Ecuador, Honduras, Mexico, Peru, Uruguay, Venezuela	IDB
Potato production with emphasis on soil fertility management	Peru	CIP/PROMESPA/ Univ Nac de Ancash
Sweetpotato improvement workshop	Uganda	CIP
Sweetpotato postharvest research workshop	Kenya, Tanzania, Uganda, Zaire	CIP/NRI
In-country course on sweetpotato	Egypt	CIP
Workshop for the formation of a network for the conservation of sweetpotato diversity in Asia	China, Indonesia, Japan, Korea, Papua New Guinea, Philippines, Thailand	CIP/IPGRI
On-farm seed potato production course	China	CIP/ESEAP/ Bashang Inst of Agric Research
Course on sweetpotato breeding	China, India, Japan, Korea, Philippines, Vietnam	CIP/ASPRAD

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Program and Title	Countries Represented	Partner Institution
Course on potato tissue culture for the production of prebasic seed & basic virology	Argentina, Chile, Peru, Spain, Uruguay	CIP
International course on Andean root crops	Bolivia, Brazil, Colombia, Ecuador, Peru, Venezuela	CONDESAN/CIP
Course on characterization, maintenance, & evaluation of sweetpotato germplasm	Argentina, Brazil, Dom Republic, Ecuador, Paraguay	CIP/IDB
Molecular markers for germplasm management and enhancement of root and tuber crops	Argentina, Brazil, Chile, Colombia, Costa Rica, Indonesia, Peru, Philippines, Uruguay, Venezuela	UNDP/CIP
In-service course on phytopathology with emphasis on bacteriology & mycology	Peru	CIP
Advanced virology course	Bolivia, Colombia, Cuba, Kenya, Peru, Philippines, Uruguay	CIP
National course on DAS-ELISA virus detection	Peru	INIA/SINITTA/CIP
Workshop on potato late blight management & seed production	Cameroon, Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Nigeria, Peru, Tunisia, Uganda	CIP
Introductory course on integrated pest and disease management of potato	Peru	CARE/CIP
Course/workshop on integrated pest management of potato	Bolivia, Nicaragua, Peru	IBD/CIP/INIA/ Asoc Arariwa
Int'l workshop on integrated pest management of potato	Colombia, Costa Rica, Dom Republic, El Salvador, Panama	CIP/CORPOICA
Int'l course on integrated management of *Cylas formicarius*	Cuba, Dom Republic, Venezuela	OPEC/CIP/INIVIT

An essential link in the technology generation-use process is the development of national capabilities to ensure adoption of CIP's research products. Every year, CIP organizes group training (workshops, courses, seminars) in regions as well as individual internships on subjects that respond to program needs, in alignment with CIP's research priorities. In 1996, 40 national scientists also received individual training in specific disciplines.

Program and Title	Countries Represented	Partner Institution
Sweetpotato tissue culture and virus indexing	Burundi, Ethiopia, Kenya, Rwanda, Uganda, Zaire	PRAPACE
In-country course on integrated pest management	Egypt, Peru	CIP
Inter-regional workshop on potato integrated pest management	Indonesia, Philippines, Thailand	UNDP/CIP
Seminar potato production from true potato seed	Brazil	CIP
Workshop on the progress of the ADB TPS project	Indonesia, Philippines, Sri Lanka, Vietnam	CIP
True potato seed course	China, Indonesia, Mongolia, Peru	CIP—ESEAP
Course/workshop on integrated watershed management in the Andean ecoregion	Bolivia, Chile, Colombia, Ecuador, Germany, Peru	ADEFOR/ CONDESAN/CIP
Course on design, layout, & administration of field experiments	Peru	CIP
Planning workshop for mountain forum activities in Latin America	Colombia, Peru	CONDESAN/CIP
Workshop on the application of crop simulation models	Colombia, France, Germany, Netherlands, Peru, Spain	CIP/CONDESAN/ Plan Meriss Inka/ IMA/CBC
Regional conference on sustainable agricultural systems in the central Andes	Bolivia, Chile, Colombia, Costa Rica, Ecuador, Italy, Peru	FAO/CIP/IICA UNEP/ CONDESAN

Research Partners

AARI	Aegean Agricultural Research Institute, Turkey
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AGCD	Administration Generale de la Coopération au Développement, Belgium
AIT	Asian Institute of Technology
ARC	Agriculture Research Center, Egypt
ARCS	Austrian Research Centre at Seidersdorf
AREA	Agricultural Research and Extension Authority, Yemen
ASPRAD	Asian Sweetpotato and Potato Research and Development
BARI	Bangladesh Agricultural Research Institute
	Benguet State University, Philippines
BMZ	German Ministry for Economic Development and Cooperation
	Bogor Agricultural University, Indonesia
BRC	Biotechnology Research Center, Vietnam
CAAS	Chinese Academy of Agricultural Sciences
CARDI	Caribbean Agricultural Research and Development Institute, Trinidad
CBC	Centro Bartolome de las Casas, Peru
CECOACAM	Central de Cooperativas Agrarias de Cañete y Mala, Peru
CEMOR	Cemor Editores & Promotores S R L , Peru
CGIAR	Consultative Group on International Agricultural Research, USA
	Chiang Mai University, Thailand
CIAAB	Centro de Investigaciones Agricolas A Boerger, Uruguay
CIAT	Centro Internacional de Agricultura Tropical, Colombia
CICA	Centro de Investigacion en Cultivos Andinos, Peru
CIDA	Canadian International Development Agency
CIED	Centro de Investigación, Educación y Desarrollo, Peru
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement, France
CIRNMA	Centro de Investigación de Recursos Naturales y Medio Ambiente, Peru
CLADES	Consorcio Latinoamericano de Agroecología y Desarrollo
CNCQS	Chinese National Centre for Quality Supervision and Test of Feed
CNPH	Centro Nacional de Pesquisa de Hortaliças, Brazil
CONDESAN	Consortium for the Sustainable Development of the Andean Ecoregion
	Cornell University, USA
CORPOICA	Corporación del Instituto Colombiano Agropecuario
COTESU	Cooperación Técnica Suiza, Switzerland
CPRA	Centre de Perfectionnement et de Recyclage Agricole de Saida,Tunisia
CPRI	Central Potato Research Institute, India
CPRO-DLO	Centre for Plant Breeding and Reproduction Research-Agriculture Research Department, Netherlands
CRIFC	Central Research Institute for Food Crops, Indonesia
CTCRI	Central Tuber Crops Research Institute, India
EMATER	Empresa de Assistência Técnica e Extensão Rural do Estado de Minas Gerais, Brazil
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária, Brazil
ENEA	Comitato Nazionale per la Ricerca e per lo Sviluppo dell'Energia Nucleare e delle Energie Alternative, Italy
EPAMIG	Empresa de Pesquisa Agropecuária de Minas Gerais, Brazil
ESH	Ecole Supérieure d'Horticulture, Tunisia
FAO	Food and Agriculture Organization of the United Nations, Italy
FONAIAP	Fondo Nacional de Investigaciones Agropecuarias, Venezuela
FORTIPAPA	Fortalecimiento de la Investigación y Producción de Semilla de Papa, Ecuador
FUNDAGRO	Fundación para el Desarrollo Agropecuario, Ecuador
GAAS	Guandong Academy of Agricultural Sciences, China
GTZ	German Agency for Technical Cooperation
IAN	Instituto Agronómico Nacional, Paraguay
IAO	Istituto Agronomico per l'Oltremare, Italy
IAR	Institute of Agricultural Research, Ethiopia
IAV	Institut Agronomique et Vétérinaire, Morocco
IBTA	Instituto Boliviano de Tecnologia Agropecuaria

ICAR	Indian Council of Agricultural Research
ICIPE	International Centre for Insect Physiology and Ecology, Kenya
IDB	Inter-American Development Bank
IDEA	Instituto Internacional de Estudios Avanzados, Venezuela
IDRC	International Development Research Centre, Canada
IESR/INTA	Instituto de Economía y Sociología Rural del INTA, Argentina
IFPRI	International Food Policy Research Institute, USA
IIN	Instituto de Investigación Nutricional, Peru
IMA	Instituto de Manejo de Agua y Medio Ambiente, Peru
INIA	Instituto Nacional de Investigación Agraria, Peru
INIA	Instituto Nacional de Investigaciones Agropecuarias, Chile
INIA	Instituto Nacional de Investigaciones Agropecuarias, Uruguay
INIAP	Instituto Nacional de Investigaciones Agropecuarias, Ecuador
INIFAP	Instituto Nacional de Investigaciones Forestales y Agropecuarias, Mexico
INIVIT	Instituto Nacional de Investigación de Viandas Tropicales, Cuba
INRA	Institut National de la Recherche Agronomique, France
INRAT	Institut National de la Recherche Agronomique de Tunisie
INSA	National Root and Tuber Crop Improvement Institute, Vietnam
INTA	Instituto Nacional de Tecnología Agropecuaria, Argentina
IPGRI	International Plant Genetic Resources Institute, Italy
IPO-DLO	Institute for Plant Protection-Agriculture Research Department, Netherlands
IPR	Institute for Potato Research, Poland
IRA	Institut de Recherche Agronomique, Cameroon
ISABU	Institut des Sciences Agronomiques du Burundi
IZ	Instytut Ziemniaka, Poland
JAAS	Jiangsu Academy of Agricultural Sciences, China
KARI	Kenyan Agricultural Research Institute
LAC	Latin America and the Caribbean, CIP region
LEHRI	Lembang Horticultural Research Institute, Indonesia
LSU	Louisiana State University, USA
	Makerere University, Uganda
MARS	Mwara Agricultural Research Institute, Indonesia
	McMaster University, Canada
MEF	Ministerio de Economía y Fiananzas, Peru
MIP	Programa de Manejo Integrado de Plagas, Dominican Republic
	Mississippi State University, USA
MMSU	Mariano Marcos State University, Philippines
	Montana State University, USA
MPI	Max Planck Institute, Germany
MSIRI	Mauritius Sugar Industry Research Institute
NAARI	Namulonge Agricultural and Animal Research Institute, Uganda
	Nagoya University, Japan
NARO	National Agricultural Research Organization, Uganda
NCSU	North Carolina State University, USA
	Nijmegen University, Netherlands
NOMIARC	Northern Mindanao Agricultural Research Center, Philippines
NPRCRTC	Northern Philippine Root Crops Research and Training Center
NPRP	National Potato Research Program, Nepal
NRI	Natural Resources Institute, UK
OAS	Organization of American States
ODA	Overseas Development Administration, UK
OPEC	Organization of Petroleum Exporting Countries
PCARRD	Philippine Council for Agriculture & Resources, Research & Development, Philippines
PDP	Potato Development Program, Nepal
PGS	Plant Genetic Systems, Belgium
PICA	Programa de Investigación de Cultivos Andinos, Peru
PRACIPA	Programa Andino Cooperativo de Investigación en Papa, CIP network

PRAPACE	Programme Régional de l'Amélioration de la Culture de la Pomme de Terre et de la Patate Douce en Afrique Centrale et de l'Est, CIP network
PRECODEPA	Programa Regional Cooperativo de Papa, CIP network in Central America and the Caribbean
PROCIPA	Programa Cooperativo de Investigaciones en Papa, CIP network in Southern Cone
PROINPA	Proyecto de Investigación de la Papa, Bolivia
PROMESPA	Proyecto de Mejoramiento de Papa, Peru
PSPDP	Pakistan-Swiss Potato Development Program
	Rothamsted Experiment Station, UK
SAAS	Sichuan Academy of Agricultural Sciences, China
SARIF	Sukamandi Research Institute for Food Crops, Indonesia
SARRNET	Southern Africa Root Crop Research Network
SCRI	Scottish Crop Research Institute
SDC	Swiss Development Cooperation
SEAG	Servicio de Extensión Agrícola y Ganadera, Paraguay
SEARCA	Southeast Asian Regional Center for Graduate Studies and Research in Agriculture, Philippines
SEMTA	Servicios Múltiples de Tecnologías Apropiadas, Bolivia
SENASA	Servicio Nacional de Sanidad Agraria, Peru
SINITTA	Sistema Nacional de Investigación y Transferencia de Tecnología Agraria, Peru
SPG	Sociedad Peruana de Genética
SPI	Smart Plant International, USA
SPPC	Seed Potato Production Center, Yemen
	Stanford University, USA
TALPUY	Grupo de Investigación y Desarrollo de Ciencias y Tecnología Andina
TARI	Taiwan Agricultural Research Institute
TCRC	Tropical Crops Research Center, Bangladesh
TFNC	Tanzania Food and Nutrition Centre
	Universidad de Ambato, Ecuador
	Universidad Austral, Chile
	Universidad Jorge Basadre Grohmann de Tacna, Peru
	Universidad Mayor de San Simón, Bolivia
	Universidad Nacional Agraria, Peru
	Universidad Nacional de Cajamarca, Peru
	Universidad Nacional del Centro del Perú
	Universidad Nacional Daniel Alcides Carrión, Peru
	Universidad Nacional Mayor de San Marcos, Peru
	Universidad Nacional San Antonio Abad de Cusco, Peru
	Universidad Nacional San Cristóbal de Huamanga de Ayacucho, Peru
	Universidad Ricardo Palma, Peru
	Universidad San Luis Gonzaga de Ica, Peru
	Universidad Técnica de Cajamarca, Peru
	University of Birmingham, England
	University of Georgia, USA
	University of Nairobi, Kenya
	University of Naples, Italy
	University of Oxford, UK
	University of the Philippines, Los Baños
	University of Tubingen, Germany
UCRI	Upland Crops Research Institute, China
UNDP	United Nations Development Programme, USA
UPWARD	Users' Perspective with Agricultural Research and Development, CIP network
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USVL	United States Vegetable Laboratory
ViSCA	Visayas College of Agriculture, Philippines
	Wageningen University, Netherlands
WE	World Education
XSPRC	Xuzhou Sweet Potato Research Center, China
YGPPP	Yemeni/German Plant Protection Project

CIP's Global Contact Points

(as of April 1997)

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Networks

■ UPWARD
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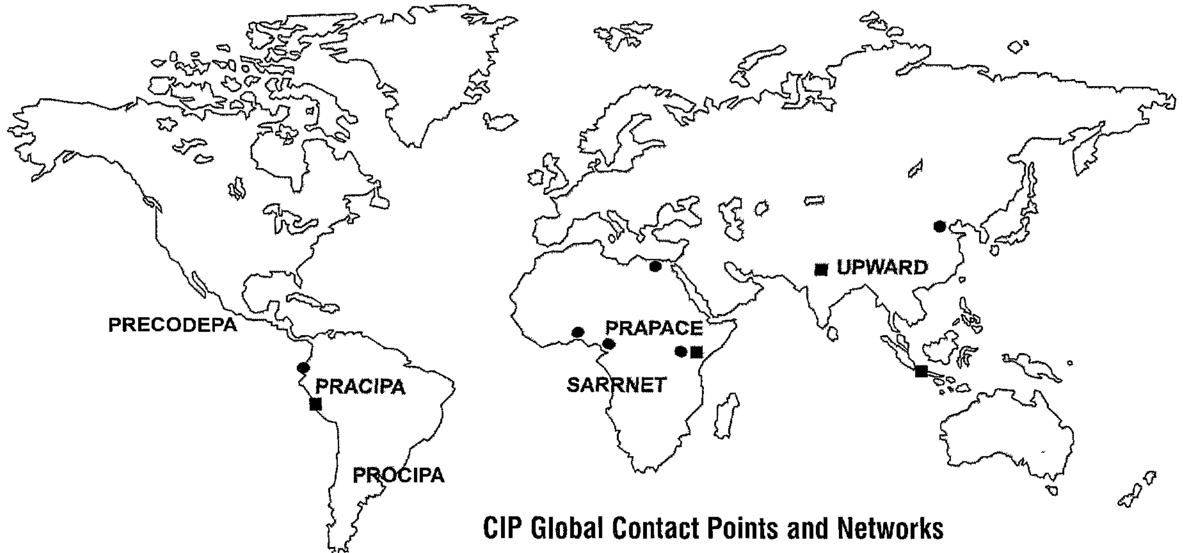


CIP Global Contact Points and Networks
● CIP Country Liaison Office ■ CIP Regional Office

CIP and the CGIAR: A Research Partnership

The Consultative Group on International Agricultural Research is an informal association of fifty-three public- and private-sector members that provides more than $300 million annually to a network of sixteen international agricultural research centers, including CIP The Group was established in 1971

The World Bank, the Food and Agriculture Organization of the United Nations, the United Nations Development Programme, and the United Nations Environment Programme are cosponsors of the CGIAR. The Chairman of the Group is a senior official of the World Bank The CGIAR is assisted by a Technical Advisory Committee, with a Secretariat at the FAO in Rome

CGIAR Mission

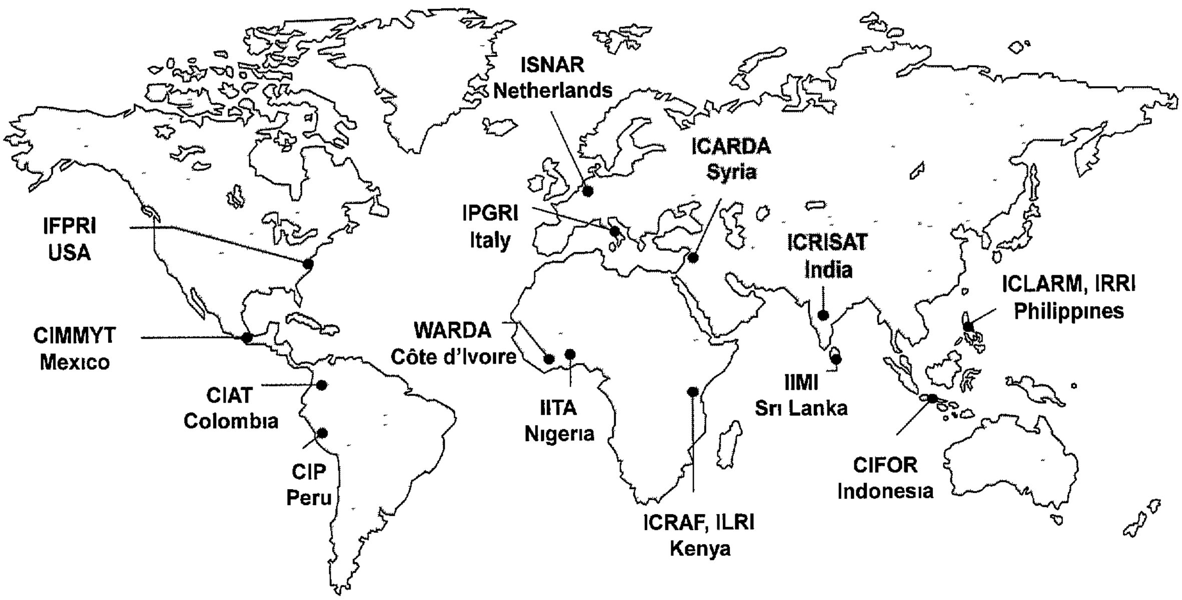
The mission of the CGIAR is to contribute, through its research, to promoting sustainable agriculture for food security in developing countries The CGIAR conducts strategic and applied research, with its products being international public goods It focuses its research agenda on problem solving through interdisciplinary programs implemented by one or more of its centers in collaboration with a range of partners in an emerging global agricultural research system Such programs concentrate on increasing productivity, protecting the environment, saving biodiversity, improving policies, and contributing to strengthening agricultural research in developing countries

Food productivity in developing countries has increased through the combined efforts of CGIAR centers and their partners. These same efforts have helped to bring about many other benefits, such as reduced prices of food, better nutrition, more rational policies, and stronger institutions CGIAR centers have trained more than 50,000 agricultural scientists from developing countries over the past twenty-five years Many of them form the nucleus of and provide leadership to national agricultural research systems in their own countries

CIP and the CGIAR

CIP was admitted to the CGIAR in 1972 in the belief that potatoes and other roots and tubers could provide new food alternatives to a hungry world Because they are naturally high-yielding and genetically diverse, root and tuber crops can be grown in vastly different ecologies and cropping systems According to the task required, they can be produced for food and fiber, as animal feed, or for a variety of industrial purposes

Increasingly, this potential is being recognized as one of the last remaining options for meeting food requirements in the years ahead Many countries, with centuries-old farming traditions based on cereals, are looking to root and tuber crops to increase food production and maintain economic growth Many are achieving this goal by tapping into the research and technological options made available from the CGIAR's investment in the International Potato Center



CGIAR Research Centers

CIAT	Centro Internacional de Agricultura Tropical
CIFOR	Center for International Forestry Research
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo
CIP	Centro Internacional de la Papa
ICARDA	International Center for Agricultural Research in the Dry Areas
ICLARM	International Center for Living Aquatic Resources Management
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IIMI	International Irrigation Management Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IPGRI	International Plant Genetic Resources Institute
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research
WARDA	West Africa Rice Development Association